THE LOUGH AND RIVER ERNE DRAINAGE AND NAVIGATION DISTRICT,

IN THE

COUNTIES OF FERMANAGH, CAVAN, MONAGHAN, AND DONEGAL.

RETURN

TO

AN ORDER OF THE HONOURABLE THE HOUSE OF COMMONS,

DATED 4TH AUGUST, 1891,

FOR

REPORT BY THE COMMISSIONERS OF PUBLIC WORKS IN IRELAND,

ORDERED BY THE TREASURY TO BE PREPARED

WITH REFERENCE TO

THE LOUGH ERNE DRAINAGE SCHEME.

Treasury Chambers,
16 February, 1892.

J. E. GORST

(*Mr. Knox*).

Ordered, by The House of Commons, *to be Printed,*

5 *August*, 1891.

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BY ALEXANDER THOM & CO. (LIMITED), ABBEY-STREET,

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LOUGH AND RIVER ERNE DRAINAGE AND NAVIGATION DISTRICT.

THE GENERAL POSITION OF THE BOARD OF WORKS IN ITS RELATION TO THIS AND OTHER COGNATE SCHEMES UNDER EXISTING LEGISLATION.

For an account of the circumstances which led to the passing of the Act of 1863 (26 & 27 Vic., c. 88), under which the works for the improvement of this District have been carried out, reference should be made to the General Review of the Drainage Acts (see Appendix No. I.) as extracted from the report of the Committee appointed to inquire into the Board of Works (Ireland), dated 20th June, 1878, and here therefore it will suffice to state the salient points.

Under the older Acts of 1842 and 1846, it was the duty of the Board of Works to prepare the plans and estimates for the works, for the drainage of 120 Districts and when the necessary assents were given, to carry them into execution.

From the works having to a great extent been designed on too small a scale, but chiefly through their having been carried out by relief labour during the distress and famine of 1846–7–8, and from delays arising out of want of funds, unexpectedly heavy liability was thrown on the interested proprietors. The dissatisfaction and complaint consequent upon this led to the appointment of the Select Committee of the House of Lords under the presidency of Lord Rosse in 1852, and subsequently to the appointment of a Commission of Inquiry, who recommended the abandonment of the undertakings in progress, leaving eleven to be completed, which were brought to a close in 1858.

The direct connection of the Board with Drainage Schemes having ceased, a movement was initiated by owners of flooded lands for undertaking Arterial Drainage Schemes under their own auspices and control, and a bill with this object was brought into Parliament by a private member which led to the Government taking up the matter and passing the Act of 1863. By that enactment the entire control over and responsibility for the promotion, preparation of plans, estimates, and valuations, also the carrying out of all Drainage Schemes, was thrown on the local Drainage Board appointed in each case under its provisions. The only duty devolving on the Board of Works was the appointment of a thoroughly qualified and independent Inspector to advise as to the suitability of the plans and estimate put forward by the Promoters, to call for and hear objections thereto, see to the protection of the public interests in the matter of county roads, bridges, &c., and finally to submit his report on the proposed scheme. On receipt of the Inspector's report the Board caused a copy thereof to be lodged for the information of all concerned, gave due notice of its lodgment, considered objections made to it, received assents or dissents to the project, and if the proprietors of more than half the present actual value of the land assented the District was constituted under Provisional Order, and the Members of the First Drainage Board (who were in all cases the nominees of the Promoters) named in the Provisional Order.

The Board of Works had nothing to do with the appointment of the Engineers employed by the Promoters for preparing the plans, &c., nor had they authority to exercise any control over the direction of the works, entering into contracts, &c.; so to interfere would be entirely against the spirit and intention of the Act, and would entail on them that very responsibility for which it was expressly framed to relieve them, and through them the State.

The district having been constituted and the Local Drainage Board formed, the loan necessary for carrying out the works is authorised by the Treasury, and advances made from time to time on application by the Drainage Board for the prosecution of the works, and although on the inquiries instituted at such times it may appear that the estimate is being exceeded, the Board of Works are unable to do more than draw attention to the facts, and to require that any deviations from the approved plans shall be duly sanctioned by them before execution. [N.B.—No deviations took place in this case.]

Though under certain circumstances they would be legally empowered to refuse further advances, and if necessary bring the district to Final Award under Treasury instructions, it is manifest that such a proceeding, as leading to the closure of works in an unfinished condition, when possibly little or no benefit had been secured after very large outlay had taken place, would throw everything into confusion, and give rise to well-grounded complaint; whereas the proprietors who would ultimately be charged, and all interested in the matter might be content, as in the present instance of the Lough Erne work, to proceed to the completion of the operations notwithstanding the enhanced cost. This matter is very fully dealt with in Mr. Le Fanu's evidence before Lord Crichton's Committee of 1878 (Question 1882, see Appendix 1), where also (Questions 1898 to 1909) the position and responsibilities of the Board of Works in reference to the Inspector appointed by them are discussed from every point of view. Their duties after seeing that none but the most competent engineers are appointed as Inspectors are summed up in the following decisive words in answer to Question 1901 :—

"The Board of Works are merely authorized to appoint him (the Inspector) as they would an arbitrator"; and again, to Question 1902, "We never revise his plans—we never meddle with his decisions at all."

For further particulars on the subject of the Drainage Acts see other extracts giving portion of evidence, before this Committee, by Mr. Le Fanu, in the same Appendix.

STATEMENT OF THE SEVERAL SCHEMES FOR IMPROVING THE NAVIGATION AND DRAINAGE OF LOUGH ERNE, FROM INCEPTION IN 1789 TO COMPLETION OF THE LAST APPROVED PROJECT IN 1890.

The improvement of the navigation of Lough Erne has engaged public attention for over a century, the first scheme of which anything definite is known (and this but little) being that of Mr. Chapman, C.E., under which work was actually commenced by the Irish Government in 1789, but subsequently abandoned.

As appears from the report of the "Committee on the State of Inland Navigation" in 1800, Mr. Chapman's scheme was revised and enlarged at a later date by Mr. Evans, an engineer who estimated the cost of "completing a navigation from the sea at Ballyshannon through Lough Erne to Belturbet and likewise to Ballyconnell," at £40,000 of which however no results are recorded.

In 1812 Mr. Killaly, C.E., acting under the instructions of the Directors-General of Inland Navigation, framed his first scheme. This he reconsidered in 1831, and in 1832 the subject was again taken up by a committee of gentlemen of Fermanagh at Enniskillen, but without result.

In 1840 Mr. Rhodes, C.E., then Engineer to the Shannon Improvements, whose services were retained, on the recommendation of the Commissioners of Public Works, submitted a "Report on the Improvement of Lough Erne, for rendering it navigable for Steam Vessels and other craft, and for keeping the Lake at a more uniform Level." The amount of his estimate was £29,797 1*s*., or with certain additional improvements, £33,313. There were no items for dredging plant, interest on borrowed money during construction, or contingencies. Nothing is moreover provided for the improvement of the navigation of the tributaries, and, on the whole, the estimate fell considerably short of the requirements.

Public meetings by the noblemen and gentlemen of Fermanagh interested in the matter were held as the result of Mr. Rhodes' report and money was subscribed. With this the Erne Navigation Company, with Mr. Roderick Gray, C.E., as Engineer, was formed, and a certain amount of dredging and excavation carried out in the channel connecting the Upper and Lower Loughs, solely in the interests of the navigation. Mr. Forsyth in his report of 1847 (see Appendix No. 2, page 25), however showed that during the summer or dry weather the level of the Upper Lough was so lowered by these operations that there was not a sufficient depth on the numerous shoals to float loaded boats over them, much less the steam tug which had been engaged in the trade, and which was consequently idle for months.

Such was the result of the various efforts extending over nearly 60 years, when the Government in 1846, impressed with the importance of improving inland navigation, offered as a free grant £8,000 (equal to a moiety of the then estimated cost) towards the proposed navigation of Lough Erne on the express condition that the proposed drainage of the flooded lands should be carried into execution in connection with the scheme.

The principal Promoters, in April, 1846, applied to the Commissioners of Public Works (they being Commissioners for the purposes of the Drainage and Improvement of Navigation Act of 1842 and subsequent Acts amending the same) praying that the navigation of Lough Erne might be improved in connection with the drainage of the flooded lands.

Under the provisions of this Act, Mr. Forsyth, C.E., then employed by the Board of Works as District Engineer for Drainage, produced his estimate and report, dated December, 1847, for text of which see Appendix No. 2, Diagram Map and Sections annexed.

This scheme, estimated to cost £108,856, provided for, (1) the main navigation of Lough Erne of seven feet throughout and the partial opening up of the tributaries, *i.e.*, of the Upper Erne, Woodford, Finn, Creeve, and Kesh rivers; (2) the drainage of the flooded lands, 17,554 statute acres; and (3) certain small county works; the leading principle being that instead of attempting to preserve a uniform level and uninterrupted navigation extending from Belleek to Crom Castle near Belturbet, the Upper Lough should ordinarily be maintained at thirty-three inches above the level of the Lower Lough, by means of a weir with sluices and a lock at Knockisland.

Mr. Forsyth contended that to maintain an uniform level at all times of the year throughout both Loughs without either ruining the navigation in summer, or submerging the lowlands in winter, would he wholly impracticable within a reasonable outlay.

The Commissioners of Public Works took the several steps required by the Act of 1842 (5 & 6 Vic., c. 89) as amended by the Act of 1846 (9th Vic., c. 4) for giving effect to the above scheme, but the necessary assents not having been given by the owners of the flooded lands, no further steps could be taken.

On a Resolution by the Grand Jury of the County of Fermanagh, at the Spring Assizes of 1852, a scheme was put forward by Mr. Roderick Gray, then County Surveyor, estimated to cost £12,000, but though purporting to deal with both navigation and drainage the provisions as affecting these objects were necessarily of only a very partial character.

After the question had been in abeyance for some years, and when, with the altered legislation embodied in the Drainage Act of 1863 (26 and 27 Vic., c. 88), the Board of Works had been relieved of any duties in regard to the preparation of plans and estimates for such schemes, a project for dealing with Lough Erne was promoted by the Rev. J. G. Porter and Mr. J. G. V. Porter, proprietors of a large extent of the lands affected. Mr. James Lynam was the Promoters' Engineer, and his estimate of April, 1870, amounting to £89,596, was inquired into by Mr. S. U. Roberts as the Inspector appointed by the Board in accordance with sec. 6 of the Act.

The objects sought to be obtained, viz.: (1) a complete unbroken navigation of fifty miles without the intervention of any lock, extending from Belleek to Crom Castle, and (2) the relief of 15,650 acres of flooded land; were precisely those which if taken in combination Mr. Forsyth, as above shown, had considered to be wholly impracticable within any reasonable outlay. Mr. Roberts for reasons assigned in his report of the 31st October, 1870 (see Appendix No. 3), declined to recommend it for approval, and accordingly Mr. Lynam, after two years, brought forward his revised scheme of 1872, estimated to cost £165,382. In this scheme, while adhering to the general principles of his scheme of 1870 as regarded the securing of a continuous uninterrupted navigation throughout both Loughs, Mr. Lynam increased the number of acres to be relieved of flooding to 17,438.

After a most painstaking and exhaustive inquiry Mr. Roberts, who was in this case also the Board's Inspector, found himself unable to recommend the scheme, as set forth in his report of 30th December, 1872 (see Appendix No. 4).

Mr. Lynam's next scheme of 1873, estimated to cost £165,289, and promoted as before by Mr. J. G. V. Porter, was reported on by Mr. Roberts on 27th February, 1874 (see Appendix No. 5). In this, recognising the validity of Mr. Forsyth's opinion, Mr. Lynam adopted practically the same method for dealing with the question as Mr. Forsyth in 1847, viz.: by (1) arranging for the Loughs being maintained at different levels by means of a weir with sluices, and a lock in the east channel at Knock Island; (2) draining the flooded lands to the extent as before of 17,438 acres.

In the following words of the report this scheme was approved by the Inspector, viz.:—"The project in its revised form will in my judgment be found effective for the relief of the low lands in the district from flooding, except in those cases of extraordinary rainfall, which, though not of frequent occurrence, cause excessive floods of short duration, for the discharge of which at a level below that of the lands, it does not appear prudent or desirable to provide, and, though the design in many of its details will still require much careful consideration, it is one which, subject to these observations, is, in my opinion, entitled to favourable consideration."

The promoter on the receipt of Mr. Roberts' report, did not see fit to proceed further with the matter, but almost concurrently with the submission of this scheme another, prepared by Mr. James Barton, estimated to cost £169,578, and promoted by Lord Erne and other proprietors, was submitted to the Board of Works under the Act of 1863.

This scheme, which was most carefully elaborated and prepared on independent lines of inquiry, practically arrived at the same conclusions as those of Mr. Forsyth in 1847. By it in addition to preserving different levels for the Upper and Lower Loughs by means of weirs and a lock at Knock Island, Mr. Barton provided very fully for dealing with all the flooded lands by improving the tributaries and nearly 100 miles of main drains.

The importance of this scheme warrants its reproduction with a reduced copy of the index map, as also the report of Mr. Roberts (dated 15th June, 1874), who was again appointed Inspector by the Board of Works (see Appendix No. 6, Diagram Map annexed). In recommending this scheme Mr. Roberts observed, "The design now submitted, will, in my opinion, be found to meet satisfactorily the demands of all the interests involved in the district, and is entitled to the favourable consideration of the Commissioners." The promoters, however, failed to obtain the needful number of assents, and the project thus fell through.

After an interval of six years a scheme by Mr. James Price, as Engineer, estimated to cost £94,000, and promoted by Mr. J. G. V. Porter, was examined and reported on (under date 6th May, 1880, see Appendix No. 7, with Map and Sections annexed), by Mr. T. Hawkesley, C.E., F.R.S., &c., one of the most eminent Hydraulic Engineers then in the profession, who was appointed Inspector under the Act by the Commissioners of Public Works. It may here be observed, parenthetically, that Mr. Roberts, being at this time one of the Commissioners of Public Works, was no longer available for holding the inquiry as Inspector.

In this scheme the principle contended for by Mr. Forsyth, and adopted in all the subsequently accepted and approved projects of maintaining the two Loughs at different levels, with weirs and a lock at Knockisland, was abandoned, and that of a uniform level for navigation purposes, extending from Belleek to the head of the Upper Lough, reverted to; the extent of land to be relieved from flood remained much the same as previously calculated, viz.: 17,405 acres.

Serious objections were urged against the principle involved, and the details of the scheme by Mr. James Barton, C.E., who appeared on behalf of Mr. Armstrong, an interested occupier, and the inspector himself in his report drew attention to the insufficient allowance for floods and discharging capacity as regarded both the channel connecting the two loughs, and of the outfall channel between Roscor and Belleek. No provision was made by Mr. Price for improving either the navigation or drainage of the tributary rivers, excepting the Finn, and that only partially; main drains to reach the remote portions of the flooded lands were also left out. The limitation of the scheme to the lowering of the level of the two Loughs, and the improvement of the river Erne as the main artery of the district were fully understood by the promoter and all the interested proprietors, and were obviously made with the object of keeping down the initial outlay, the large amount of which had proved fatal to the adoption of all previous projects, leaving the improvement of the tributaries and main drains to be dealt with hereafter.

Mr. Price's scheme, though departing from the main principle as contended for by Mr. Forsyth in respect to the navigation, and, as shown, leaving out nearly all subsidiary works required for main drainage, still embraced vitally important operations without which all other improvements would have been entirely useless; in other words, though falling short of the standard aimed at by Mr. Forsyth and the other able Engineers who advocated nothing short of a complete and comprehensive scheme, especially in regard to navigation, Mr. Price's laid the foundation for such being eventually accomplished.

Under these circumstances the inspector, Mr. Hawkesley, approved of the scheme in the following words:—

1. "That, although the scheme (unless amended as herein proposed) may not accomplish quite all that has been expected from it, because of the more than usual rapidity with which the catchment area discharges the rainfall into the Upper Lough Erne, yet that, in my judgment, the benefits which the proprietors and occupying farmers will derive from the permanent reduction of the height of the loughs during ordinary wet weather, and the prevention of the now usual and almost periodical floods, are so certain and substantial as to warrant your Honourable Board in according their approval to it, and that with the suggested amendments it will be capable of accomplishing as perfect a drainage of the loughs and injured lands as can be effected by a reasonable and reproductive expenditure of capital on these works of permanent improvement; and

2. "That in my opinion the navigation of the loughs and river will not be injuriously affected, and that the course of the vessels passing into and out of the communicating canals will be both shortened and facilitated."

As modified by the Inspector, Mr. Price's estimate, amounting, with £5,800 for interest during construction, to £93,400, was increased to £104,000, as follows:—

Cost of works, navigation and drainage, including £2,000 for claims for compensation, &c., &c.,	£78,318
Contingencies,	11,748
Total Works,	£90,066
Engineering, Valuation, &c., &c.,	7,206
	£97,272
Add interest during construction for three years,	6,728
	£104,000

The area of land to be drained or improved, as stated in the Inspector's report, was 17,266 statute acres; the then annual value thereof being £10,103, and the estimated increase in the original value, £5,251 per annum.

In August, 1880, the promoter furnished proprietors' assents, representing 9,857 acres, the actual annual value of which was £5,995, being £944 over the moiety.

The dissents represented no more than 527 acres of such lands and a present actual annual value of £266.

The Commissioners issued their Provisional Order 3rd August, 1880, which was confirmed by the Drainage and Improvement of Lands Supplemental Act (Ireland), dated 7th September of the same year.

The works were commenced in June, 1881, and brought to a close in July, 1890.

Before proceeding to touch on other matters, it appears desirable here to compare as far as possible the estimates and probable cost of the more important of the several schemes as above adverted to, which have been put forward since 1847, including Mr. Price's, which has been carried out.

As during the period which has elapsed since 1847, the rates of labour have advanced much more rapidly than ever before known, it is essential in comparing the various schemes to make due allowance for this circumstance.

It must also be borne in mind that while all estimates for works of arterial drainage have necessarily to be framed under the assumption that the conditions under which the works are carried into execution are generally favourable, *e.g.*, that there are no very excessive floods in the river; that there is an absence of strikes or accidents among the work people; that no unreasonable demands for compensation are preferred by owners of fisheries and properties of all kinds; that the rock under water turns out to be no greater in quantity or harder in quality than disclosed by previous borings, &c., &c., it is nevertheless in the nature of things, and especially in regard to river works, that causes of possible excess exist which cannot be foreseen or estimated for beforehand, and in reference to which previous warnings cannot *ex hypothesi* be given.

The excesses over estimate of all similar works carried out in Ireland by Local Drainage Boards under the Act of 1863 have, owing chiefly to the accidental and unforeseen circumstances above alluded to, been very considerable. That some of the owners of the lands to be drained were fully alive to the contingencies referred to, and were unwilling for that reason to assent to the execution of the works for the drainage of the District, was given in evidence at one of the meetings recently held by one of the Commissioners for the purpose of fixing the amount of increased rent—due to the improvement effected by the drainage—and it was further shown that the assents of those proprietors were not given until the occupiers of the flooded lands had brought considerable pressure to bear on them to induce them to do so, and had voluntarily given written undertakings to pay such charge as would be placed upon their respective holdings for the drainage of the District.

As shown by the appendix to the first report of the Royal Commission on Irish Public Works, dated 9th April, 1887, and subsequent returns of the fifty-three Arterial Drainage Works so carried out under the Act in question, the excesses over the original estimates amounted in four cases to 100 per cent., and to 50 per cent. and upwards in fourteen others, while the average for the whole gives an excess of 48 per cent.

The following is a summary of the several schemes adverted to :—

Year.	Author of Scheme.	Estimate.
		£
1847	W. Forsyth, C.E.,	108,856
1870	J. Lynain, C.E.,	89,596
1873	Do.,	165,382
1874	Do.,	165,289
1874	James Barton, C.E.,	169,578
1880	James Price, C.E.,	104,000

In concluding this part of the subject, see Appendix No. 8, in which the facts connected with the several schemes hitherto put forward have been put together for facility of reference in a tabular form.

It now becomes necessary to advert to certain matters which have lately attracted attention in Parliament and elsewhere, viz. :—

(1.) The constitution and action of Drainage Boards including that duly appointed under the Act for the Lough Erne Scheme.

(2.) The certificates of outlay submitted to and the audit carried out by the Board of Works.

(3.) The causes of excess outlay in this case.

(4.) The Final Award with charges on the Proprietors.

(5.) The charges in the form of increased rent to be put on the tenants.

(1.)—The Constitution and Action of the Drainage Board.

After the report of the Inspector on a proposed drainage district has been lodged with the Clerks of the Peace and the Unions for the period prescribed by the Acts, and the formal objections thereto having been inquired into, it is then competent for the proprietors to give their assents to the execution of the works.

Should the assents be given for over a moiety of the present actual value of the lands to be drained and improved, and one-third not dissenting, the Commissioners make their Provisional Order constituting the district. It devolves on them, as soon as conveniently may be after this, to take all proper steps for its confirmation by Act of Parliament; and the works, when this has been obtained, can be then proceeded with by the District Board constituted thereunder.

The Provisional Order so confirmed, contains the names of the first members of the Drainage Board who have agreed to act, as submitted to the Commissioners by the promoting proprietors. Subsequent Drainage Boards are elected annually in September, according to the voting power defined in the order, which also names the period within which the works are to be completed, the Commissioners having power to extend the period according to circumstances.

Pursuant to the power thus vested in them, the Commissioners of Public Works in Ireland, by their Provisional Order, dated 3rd August, 1880, made the following regulations as regards the Drainage Board for the Lough Erne Scheme :—

"That the Drainage Board for said district shall consist of eleven members. That the following persons shall be the members of the first Drainage Board, viz :—

Captain Mervyn Edward Archdale, of Castle Archdale, Irvinestown, Co. Fermanagh.
Captain William Collum, of Belview, Tamlaght, Enniskillen, „
Lieut. Col. the Hon Charles Crichton, of Crom Castle, Newtownbutler, „
(Representing the Right Honourable the Earl of Erne.)
Francis John Graham, of Drumgoon, Maguire's Bridge, Esq., „
Colonel John Graham Irvine, of Killadeas, Ballycassidy, Esq., „
John Arthur Pomeroy, of St. Angelo, Ballycassidy, Esq., „
John Grey Vesey Porter, of Belleisle, Lisbellaw, Esq., „
Edward Smith, of Enniskillen, Esq., „
(Agent for the Right Honourable the Earl of Enniskillen.)
Gartside Tipping, of Rosferry, Lisnaskea, Esq., „
John Archibald Wood, of Willoughby-place, Enniskillen, Esq., „
Frederick Wrench, of Lurganbrae, Lisnaskea, Esq., „
(Agent to the Right Honourable the Earl of Lanesborough.)

The Local Drainage Board thus constituted, and annually reconstructed by fresh elections each successive September as provided in the Act, had from the outset to deal with more serious difficulties than had fallen on any similar body before in Ireland. They had to meet and provide for the delays and disappointments arising out of the extremely arduous character of the excavations in the river bed between Roscor and Belleek (as dwelt on by Mr. Price, their Engineer, in his explanations under head (3) below), to defend themselves against successive actions by owners of fishery rights, etc., sometimes of a very unreasonable character, to comply with the requirements of the Fishery Inspectors as regards the fish passes at Belleek, which proved a most serious undertaking productive of unlooked for results, and above all to face demands for the unusually large excess of outlay over estimate, arising from circumstances in very great measure beyond their control.

That they persevered for eleven years in their arduous task speaks highly for the spirit with which they were animated from the first, and though not a professional body, there is no reason to believe that any but immaterial errors can be attributed to defects in this regard or to any want of business-like attention to the work before them.

It is almost needless here again to say that the Commissioners are in no wise empowered under the Act to regulate the manner of executing the works either by appointing the Engineering staff, buying plant, making contracts, &c., though when applied to for advice they have always been prepared to give it without making themselves responsible, and take the precaution of seeing that the amount of the loan is based on a contractor's tender.

(2.)—THE SUPPLY OF FUNDS, ALSO ACCOUNTS SUBMITTED TO AND AUDITED BY THE BOARD OF WORKS.

When a Drainage Board has been duly constituted it applies to the Commissioners for the full amount required for the works as a loan, and they obtain Treasury sanction therefor, advances of certain instalments of the loan, after the first, being made from time to time under the following procedure :—

Memorial.—This is addressed to the Commissioners of Public Works, and states amount of instalment required. It is under the Seal of the Drainage Board, and is signed by its Secretary.

Abstract.—The Memorial is accompanied by a statement of the amount of the estimate for each section of the work, and for contingencies ; also of the actual value of the work done to date. This statement or abstract is signed by the Engineer and Secretary to the Drainage Board jointly.

Details of Work.—Details of measured work in support of the foregoing abstract then follow, the correctness of which is ascertained by the Engineer to the Board of Works (or his assistant) after personal inspection and examination of the works on the spot, and that Officer has to satisfy himself that the expenditure has been properly incurred under the approved plans and estimate, and also that the Board's approval has been obtained for deviations therefrom. As before remarked, there were no deviations in this case.

Schedule of Disbursements.—This Schedule, signed by the Secretary to the Drainage Board, follows next in order, and commences by the bringing forward of the total amounts previously audited and allowed by the Accountant to the Board of Works, viz:—

I. Approved Expenditure other than on works, . . .	£
II. Works only, ...	£

Then follow, in separate detail, the items for examination, each supported by its proper voucher, bearing the signature of the Chairman of the Drainage Board. These are carefully scrutinized and examined by the Board's accountant who acts as auditor.

Joint Certificate of Engineer and Accountant.—When the Engineer and Accountant have completed their examinations of the works and accounts, respectively, as above, they are required to join in a certificate setting forth the following details :—

I. Gross value of works, not including contingencies, . .	£
II. Other claims approved, ...	£
Total,	£
III. Total disbursements vouched, ...	£
IV. Amount of advances already made, ...	£

Order of the Board.—Upon consideration of the foregoing certificate, the Board makes its order, by minute, for the issue of the instalment applied for, or for such lesser sum as it may appear advisable to issue.

The whole procedure, as above detailed, and forming a connected chain of evidence as to the validity of the accounts, which it would be difficult to amplify or improve on, has been strictly observed in the case of each instalment of advance made in the Lough Erne Scheme. The original documents are lodged at the office of the Board of Works, and are open to inspection.

(3.)—THE CAUSES OF EXCESS OUTLAY IN THIS CASE.

Mr. Price, C.E., the author of the scheme which has been carried out, and on whom, owing to the circumstances of the Local Drainage Board not being able to obtain a contractor, devolved by far the most difficult portion of the works, has, on being applied to, furnished the following statement of the various causes of excess, and looking to his high standing and long experience in the profession, the facts as recorded by him will no doubt be sufficient to show that the difficulties which disclosed themselves as the work advanced, and other unexpected causes of expenditure, have been quite sufficient to account for the scheme proving much more costly than estimated, without it being necessary to attribute any blame either to him or to the Local Board.

EXTRACT FROM MR. PRICE'S STATEMENT.

"This scheme of drainage and navigation was reported on favourably by Mr. Hawkesley, in May, 1880, who added £10,000 to the estimate for increased channels only. Whereupon the required assents of the landlords were obtained, a Drainage Board was formed, and I was appointed their Engineer and instructed to prepare detailed plans and specifications so as to obtain contractors for the execution of the works, and for a dredger, which had to be built specially for the use of a contractor. The plans, &c., were ready in February, 1881, and tenders were sent in. The lowest tender, dated April 9th, 1881, for the whole work amounted to £97,794, was that of Mr. Thomas Waddell of Edinburgh, a well known contractor who had ample means, plant and staff to complete the work, and though rather above the estimate it was considered by the Board prudent to accept it. The Board could not however accept it at the time, as a fresh Act of Parliament regulating the mode of assessment of the Navigation Grant was required. Mr. Waddell sent over his Engineer to inspect the dredger being built at Hull; all the improvements suggested by him were adopted and he was quite satisfied with the dredger, but not so with the clay into which he had sunk the trial pits, with respect to which his words were "that no dredger that was ever made would cut it." As he had time to consider and in the meantime had taken up other extensive contracts he would not confirm his tender when the Board had power to accept it formally. Tenders were again advertised for, and Mr. Robert Pitt of Liverpool sent in the lowest tender, his tender of February 25th, 1882, amounting to £91,647 (after being adjusted) was accepted. Mr. Pitt commenced work in May, 1882, and abandoned it in September of the same year, without having done any important part of the work. The plant he had was seized by the Board, who instructed me to carry on the works as a matter of necessity to prevent serious flooding in consequence of the drains put in by Mr. Pitt, and to proceed pending fresh contracts. Everything was done to induce other contractors to undertake the whole works but without effect as the refusal of two contractors to proceed had given the work a bad name. The works were therefore carried on by the Board under my superintendence, and in May, 1884, the works from Portora upwards, which were much less formidable, were let to Mr. John Best, of Scotland, however at what might be called a high price, in fact labour had risen from 12*s.* to 15*s.* per week, which would account for much of the increase. There is no doubt as to the extreme and unexpected difficulty of these works which added to their cost, but it was in expenditures, other than on works, where the great extra expenses were incurred (see below), mainly in compensation for fishing and other rights, and legal expenses. For instance, an eel weir had to be removed at Belleek, and another was substituted, but the owners refused to take the substituted eel weir, which was proved by subsequent fishing by the Board to be just as good, and the owners were awarded £9,500 by a jury as compensation for the loss of eels, which they catch by their weirs further down. The same owners, being also proprietors of the salmon fishery, received large compensation for injury alleged to be done to the salmon fishing, which subsequent facts proved to be *nil*, on the contrary an improvement has perhaps taken place from the great facility of ascent of the fish, produced by the drainage works. Another eel weir for which £1,000 and costs were paid had been actually bought up by the county years before for £300 as being an obstacle in the river, but unfortunately the money was wrongly paid to the life owner. The Board having, as they thought, bought up all the rights in the Belleek weir fished it themselves to ascertain its value for sale, but were prevented by injunction from either fishing or selling, the judgment of the Master of the Rolls was to the effect that the verdict of the jury in some way extinguished the rights of the Board. It must be also remarked that the Board was put to very great expense in consequence of the requirements of the Fishery Inspectors for accommodation works; the salmon ladder proposed on the original plan was of a very simple character, but would have been, perhaps, more effective for the ascent of fish than the very costly and troublesome works required for the Fishery Inspectors instigated by the Fishery Company. The salmon pass first ordered by them was defective in design; it had to be altered at considerable expense, and subsequently an auxiliary pass made. These works all involved heavy rock cuttings in water. The Fishery Company also obtained rights of interfering with the use of the sluices and stopping the dredging during the summer months, thus delaying the works and adding to their cost, over all these matters the Board had no control, and in resisting them they had to incur heavy legal expenses. There were also claims from people at Ballyshannon alleged to be flooded during the progress of the works; some of these were lately tried at Derry Assizes, when out of thirty-three plaintiffs twenty got nothing, and the remaining thirteen got £51 among them. This shows how frivolous and unreasonable were these claims, and yet how costly to the Board having to defend four records at two assizes. This is only one of a series."

. . . . . .

"19th August, 1891."

"(Signed), JAMES PRICE.

EXPLANATIONS OF EXCESSES OVER ESTIMATE.

—	Outlay.	Original Estimate.	Increase.	Per Cent.	Remarks.
	£	£	£	£	
Belleek to Rosscor, carried out by Drainage Board.	94,682	57,003	37,679	66	Excess accounted for by 124,000 cubic yards of rock found under the clay, extremely hard nature of clay, requiring to be blasted. Cost of works for Fishery Company, and increase of wages 25 per cent.
Portora, upwards, carried out by Contract.	44,896	28,002	16,894	60⅓	Same remarks apply with the exception of less extra rock, and no works for Fishery; also scare of two Contractors having given up the works.
Compensation, Law, Engineering, Secretary, and Expenses, not works.	40,245	12,267	27,978	228	Extraordinary claims made for Fishery rights, &c., Law Costs, and expenses occasioned by delay of works.
*	179,823	97,272	82,551	–	—
Interest, . . .	32,000	6,728	25,272	475	Delays.
	211,823	104,000	107,823	–	

(Signed),

JAMES PRICE, M. Inst. C. E.

August 31st, 1891.

* Credit has been given for sale of Dredging Plant.

In supplementing the above statement of Mr. Price as to the causes which contributed to the large increase in cost over the original estimate, it should be added that when the Drainage Board applied for the additional loan of £50,000, made on 5th September, 1885, and subsequently of £25,000, made on 4th August, 1887, they were called upon by the Board of Works to furnish detailed information showing the causes of the excess; and it was only on this proving to be conclusive as justifying the further outlay that the Commissioners considered themselves bound, under the provisions of the Acts, to make the further advances required to complete the works.

As it has been alleged that the delay in issuing the first instalment of the Drainage loan, early in 1881, was caused by the Board of Works, and that to this delay is attributable great enhancement of the cost of the works from the withdrawal of a contractor, Mr. Waddell, who had tendered on very favourable terms, it is necessary to enter into this in some detail.

The Lough Erne scheme consisted of two distinct works.

1. *Navigation* under the Act of 1842, 5 & 6 Vic., c. 89.
2. *Drainage* under the Act of 1863, 26 & 27 Vic., c. 88.

Both operations were to be carried out by the one body (the Local Drainage Board) under the Act of 1876, the Erne Lough and River Drainage Act, 39 & 40 Vic., c. 237 (local).

As they were unable to constitute themselves within the period of three years named in this Act the term was enlarged to five years under the amending Act (local) of 1879.

The Drainage Board was eventually constituted in September, 1880, and in January, 1881, application having been made for the loan of £74,000, the Board of Works recommended this for Treasury sanction. It was then discovered that in order to take advantage of the Act of 1876 it devolved on the Drainage Board to obtain further legislative powers, which no doubt through an oversight they neglected to do till the difficulty as above shown became apparent.

The Board's Counsel and subsequently the Law Officers of the Crown were consulted as to the steps to be taken, and in March, 1881, they advised that the prudent course would be to obtain a further Act to explain and amend the Act of 1876. No time was lost in framing the Bill, but owing to quite unlooked for opposition in Parliament this did not become law till the 27th August, 1881.

In the mean time as the Board of Works, being quite alive to the undesirability of delay as a working season might thus possibly have been lost, and being necessarily most anxious to help the Drainage Board in every way, suggested as a temporary expedient that a certain sum of money (£3,000) might be advanced to enable the works to proceed, pending the passing of the Bill, if four of the promoters would join in a bond to the Commissioners securing this amount.

Four gentlemen, Mr. J. G. V. Porter, Col. J. G. Irvine, Captain M. E. Archale, and Lieutenant E. M. Archdale, R.A., came forward in a very generous manner to execute the Bond, and the advance of £3,000 was made 21st of June, 1881.

Had there been no difficulty in regard to making the first advance as here described, this would in due course have been issued about the 1st February, 1881; consequently the total extent of the delay on which so much weight has been placed amounted to no more than four and a half months in all. It was as shown caused by the Local Drainage Board through oversight not taking prompt action immediately on being constituted in September, 1880, and the difficulty was surmounted by the assistance of the Board of Works with the least possible delay.

It is also incorrect to attribute to this short delay the enhanced cost of the works from the withdrawal of the contractor, Mr. Waddell, whose favourable tender had been accepted. He did so, not in consequence of the delay, but, as he himself stated to the Drainage Board, because he "thought that no dredger that ever was or can be built can fufil Mr. Price's conditions in Lough Erne," and he declined to conclude the contract unless a clause was inserted to the effect that "In the event of the dredger provided by the Drainage Board being unable to dredge the quantity guaranteed additional time should be allowed for doing the work, and any extra cost caused thereby be decided by the Engineer or Arbitrator appointed." The Drainage Board declined to agree to such a clause and Mr. Waddell withdrew his tender.

Subsequent events have shown that Mr. Waddell was mistaken in his assertion that Mr. Price's dredger would not prove equal to the work before it in excavating the stiff boulder clay which forms so much of the bed of the channel between Roscor and Belleek.

(4.)—The Final Award with Charges on the Proprietors.

The works having as above shown been completed in July, 1890, the Commissioners of Public Works, pursuant to the provisions of the Act, prepared their draft award, and lodged printed copies thereof with the Clerks of the Peace for the Counties of Fermanagh, Cavan, Monaghan, and Donegal. Notice of such lodgments, dated the 29th August, 1890, required all persons who desired to lodge objections to said draft award, to do so on or before the 18th September ensuing, and further stated that the Commissioners would hold a meeting of all persons interested on Wednesday, the 1st October following, in the Court House, Enniskillen, at the hour of 10 o'clock a.m., to hear evidence as to any objections which may be lodged.

At this meeting Mr. Roberts presided as Commissioner of the Board of Works; there were a number of professional gentlemen present on the part of the proprietors, and a great many proprietors represented their own interests. Those present unanimously agreed that to enable them to prepare evidence a postponement of the proceedings was desirable, which the chairman ultimately granted.

A further notice, dated 17th October, was published by the Commissioners fixing the times and places for their adjourned attendance to hear objections to the draft award, and extending the period for lodging objections to the 21st December, 1890.

Pursuant to such notice meetings were held at the following places, and the objections lodged heard :—

At Enniskillen, on the 13th, 14th, and 15th January, 1891; Clones, 20th and 21st; Belleek on the 27th; and again at Enniskillen on the 11th and 12th March following.

The draft award was revised, alterations made, and finally settled on the 4th April, and enrolled on the 2nd May last.

	£
The amount of public advances,	149,550
Interest thereon to 9th October last,	32,008
Consolidated sum,	£181,558

which is chargeable under the award for drainage, repayable by a rentcharge of £7,262 per annum, payable half yearly for 49 years.

The area of lands drained and improved is 15,327 statute acres. The original annual value, £9,428. The increase in the original value £4,717 per annum.

(5.)—CHARGES IN THE FORM OF INCREASED RENTS TO BE PUT ON TENANTS.

Under the 56th section of the Drainage and Improvement Act (Ireland), 1863, and the Drainage and Improvement of Lands Amendment Act (Ireland), 1872, the Commissioners are empowered, on the application of a proprietor, within the meaning of the Drainage Acts, after the completion of the drainage works, to determine the amount of increased rent the tenant or occupier shall pay, whether holding under a written agreement or not, for the benefit derived by means of the drainage works. The tenant, however, has the option under this Act of paying the annual rentcharge which would cover the expenses of such works. It provides also that notice shall be given by the Commissioners to the occupier or other person whose rent is proposed to be increased of the intention to make such increase, and also of the time and place for such occupier or other person to appear before the Commissioners to make objections which he may have to his rent being increased. The decision of the Commissioners when giving an increased rent is to be on a sealed separate instrument.

In determining increased rents the Commissioners are in no way influenced by the charge which may have been put on the proprietor under the final award, or whether the district is a paying one or not. They take all the circumstances of each case into consideration as to what degree of actual benefit the tenant has derived, and nothing else. The following examples illustrate how, apart from and previous to the award in the case of the Lough Erne District, the matter has worked in various instances:—

Fifty-six tenants in the Swilly Burn Drainage District, Co. Donegal (1887), agreed to accept the alternative of paying their proportionate rentcharge to their respective proprietors for a term of 35 years, thus practically relieving the latter of all charges instead of having a permanent increased rent fixed on them.

In the Upper Morning Star District, Co. Limerick, in 1889, an application was made on behalf of the proprietor to the Commissioners to determine the amount of increased rent thirteen tenants should pay by reason of the benefits conferred on their farms by the drainage works. The tenants at the meeting held by the Commissioners for this purpose, objected to any increase on the grounds that their rents were too high, and in proof of this they stated that their rents had been abated temporarily 20 per cent. during the operation of the works, and that the abatement had continued after their completion. The agent on examination admitted that it was not the intention of the proprietor to withdraw the abatement, as he considered the reduced rent fair. Although it was not denied by the tenants that benefit had been conferred on their farms by the drainage works, yet the Commissioners refused to give any increase in rent.

A similar case is that of the Ballyteigue and Kilmore Drainage District in 1889, in which tenants were interested, and the like decision was given by the Commissioners.

In general the increased rents fixed by the Commissioners on tenants are considerably under the proportion of the drainage charge which the proprietors have to pay on the holdings, as will appear from the following:—For the three years ending June, 1891, there were thirty-one cases in which the Commissioners held meetings for fixing increased rents. The aggregate amount of increased rents applied for by the proprietors in these thirty-one cases was £286 16*s*. 4*d*., the proportionate rentcharge thereon, including maintenance payable by the proprietors, being £299 15*s*. 8*d*. The aggregate of the increased rents applied for was reduced by the Commissioners to £164 12*s*. 7*d*., so that the amount of the increased rents fixed was not more than 55 per cent. of the amount which the proprietors were charged with.

It is to be observed that generally at increased rent meetings the proprietor and tenant are represented by solicitors, and occasionally by counsel. In cases where the evidence is conflicting, or where the presiding Commissioner may have doubts as to the enhanced value of the lands drained and improved in a holding, he directs the Valuator of the Board of Works (an officer of great experience) who is present when the evidence is given, personally to inspect the lands; also to see that a proper and efficient outfall has been given to them for further improvement.

Where the tenant is dissatisfied with his rent, increased for drainage, he has the alternative of applying to the Land Court for a judicial rent. Even in that case the tenant can, after the expiry of his fifteen years, appeal to the Land Law Court and have a fresh consolidated judicial rent fixed. Thus the interests of the occupier being doubly protected, *first*, by the procedure and practice of the Board of Works, and *next*, by the Land Law Court, there is not the slightest foundation for the allegation which has been put forward to the effect that the charges for the cost of drainage works, though ostensibly borne by the landlord, is in reality transferred to the occupier.

As regards the increased rents to be put on the occupiers in the Lough Erne Scheme it is only necessary here to observe that the matter which has now for some time been under investigation by one of the Commissioners has not as yet been concluded.

GENERAL OBSERVATIONS.

With the exception of that of the Shannon, no more difficult or complex problem, involving the reconcilement of so many conflicting requirements, has come under consideration in the matters of navigations and drainage in Ireland than the Lough Erne Scheme, and in the initiatory steps, when the responsibility of framing a comprehensive scheme devolved on the Board of Works under the Act of 1842, and Acts amending the same, a project was framed under their orders on true scientific principles which, as shown above, have reasserted themselves in all subsequent approved schemes down to 1877, and which remain now as true as when first enunciated.

Nothing but the absolute impossibility of obtaining the necessary assents, as required by law, to the large outlay involved, as proved by repeated failures, prevented the execution of some one of the many schemes framed by a succession of able Engineers and approved by the Board's Inspector, making it evident that a project on a modified and less costly scale could alone succeed in enlisting the needful approval of the interested proprietors and occupiers. The proprietors, on whom the whole charge was to fall under the Act of 1863, had been familiarised with the facts and requirements of a complete scheme by the discussions extending over about forty years prior to the production of the modified scheme in question, and consequently on the approval of this by probably the most eminent hydraulic engineer of the day, the late Mr. Hawkesley, the duty of the Board of Works was clear.

Having regard to Mr. Hawkesley's approval of the scheme, and to the policy of the Act which was passed with the object, amongst others, of substituting the initiative of the local promoters for that of the Board of Works, the Commissioners held that they would have departed seriously from the intention of the Legislature if they had thwarted the prosecution of a scheme which, though not aiming at the same high standard as in their own and previously approved projects, was, nevertheless, not inadequate for the more immediate purposes for which it was designed.

This view is strengthened by the following considerations :—

(1.) That the scheme as finally approved, though modified and curtailed in its scope, provided for works all of which must necessarily have formed portion of the more comprehensive measure originally advocated by their own professional advisers, and by subsequent engineers; (2.) That certain special advantages might eventually be expected to accrue, if the owners and occupiers along the remote portions of the tributaries subsequently found it to be their interest to take these up as separate drainage schemes under the same enactment—a contingency not unlikely to arise at some future day; and (3.) That, as proved by the almost unanimous assents given to the scheme, and subsequently by their persevering to carry out the works in the face of unexpected heavy excess of outlay over estimate, the proprietors were content to incur the charge.

All subsequent proceedings were in strict accordance with the procedure laid down by law, and it may be affirmed that the various allegations which have been made as regards the action of the Board of Works in reference to this scheme, and which are summarised below, not one has the slightest foundation in fact.

1. The scheme which has been approved of and carried out is that for which the promoters are alone and wholly answerable under the Act of 1863, which, as shown, was passed with the express object of transferring from the Board of Works to local promoters the business of originating and carrying out such projects.

2. As regards the Inspector appointed by the Board, their duty under the Act required them to nominate a thoroughly independent and competent Engineer (as they would an arbitrator in cases of land valuation under certain other Acts,) and having done so they had no legal power whatever when constituting the district to interfere with or modify his plans or decisions in any way.

3. Statements to the effect that the Board of Works, as having nominated the members of the Local Drainage Board, were responsible for their actions and the extra expenditure incurred over estimate, are equally devoid of foundation, as the Board in the *first* place merely fulfilled a duty imposed by the Act in appointing as members of the first year's Local Drainage Board certain gentlemen whose names were submitted as the fittest by the promoters and interested owners, and who were on inquiry found willing to take on themselves the responsible duties. The Act defines the manner in which elections for successive annual renewals of the Drainage Board were to be held, and in the *second* place the Board of Works had merely to satisfy themselves, on receiving statements of outlay with requests for successive advances, that such outlay had been incurred and was properly chargeable to the scheme as approved originally by the Inspector, extending the period of execution, if necessary, &c. They had no legal authority to appoint engineers, buy plant, make contracts, or in any way interfere with the actual execution of the works; in fact to do so would, as before remarked, be to undertake the very responsibility which it was the express object of the Act of 1863 to relieve them from, and to place, unreservedly, upon the duly constituted Local Board.

4. A statement has been put forward in a memorial by the proprietors that owing to delays arising out of defects in the first Act constituting the district, viz., the Act of 1876, the Local Board were unable to hold their first contractor for the works, to a very favourable agreement, which they had made with him, and that this led to their being compelled, eventually, to take up the works and prosecute them through their own agency at a very much greater cost than would otherwise have been the case.

The facts as to the circumstances connected with the Act of 1876, and the manner in which the difficulty which arose was promptly met by the Board of Works have already been sufficiently explained. The delay was not the cause of the contractor in question withdrawing from his agreement. As stated by himself he declared that no dredger invented would take out the stuff in the Roscor-Belleek Channel, although this subsequently proved not to be well founded, as Mr. Price's dredger, though with difficulty, accomplished the work successfully. A contractor, who came forward subsequently, very soon abandoned the work, and after failure to obtain further tenders, it had to be carried out through the direct agency of the Local Board. The delay therefore due to the Act of 1876 had nothing whatever to say to the extra cost of the work.

5. Allegations have been put forward to the effect that the expenditure on the Lough Erne Drainage Works was not subject to any proper audit, that the accounts were unsigned, &c. Fortunately all the original accounts are forthcoming and are open to inspection, and it may be safely averred that probably no statement of accounts can better stand any tests which may be applied.

They are duly signed, certified, and audited by all the responsible officers, and bear on their faces proofs of this in the form of check or emendation in regard to every single entry.

6. It has further been alleged that the charge placed by the Final Award of the Board of Works on the proprietors will in reality be made to fall on the occupiers in the form of increased rent. According to the return of applications for determining the increased rent which the occupiers of the lands in the district will have to pay in consideration of the direct benefit conferred on their holdings by the works executed in the district, it is not improbable that as many as 1,600 cases (1,000 of which have already been heard) may have to be decided by the Commissioners, and it is therefore impossible under existing circumstances, and while these are *sub judice*, to say how much may have to be imposed on the tenants in consideration of the actual benefit derived from the works in the form of drainage.

But as already shown by their action in the case of the Upper Morning Star District, and of the Ballyteigue and Kilmore District in 1889, where they refused for reasons assigned to put any increased rent on the tenants and again an aggregate of all the cases under the Act of 1863, where they have as a fact only put increased rents to the average of 55 per cent. on the amount charged to the proprietors it will be at once seen how entirely groundless is this allegation, and how anxious the Commissioners have always shown themselves to act with the strictest justice to all the parties concerned.

It would be premature to offer any remarks on the assertion which has been made in Parliament that members of the Local Drainage Board, considerable land owners, are ready to substantiate charges of jobbery against the Board of Works in connection with the Lough Erne Scheme till the names of the gentlemen alluded to have been disclosed and the charges formulated.

It only remains to be said in reference to the allegation that the Board are afraid to face a fair and open inquiry, that individually and collectively they would invite the very fullest investigation.

By Order,

W. B. SOADY,

Secretary.

Office of Public Works,
Dublin, 31*st December*, 1891

APPENDICES.

APPENDIX No. 1.

LOUGH AND RIVER ERNE DRAINAGE DISTRICT.

GENERAL REVIEW OF DRAINAGE ACTS.

(As Extracted from the Report of the Committee appointed to inquire into the Board of Works (Ireland), dated 20th June, 1878.)

The question of Arterial Drainage in Ireland may be said to have occupied the attention of the Imperial Legislature for nearly half a century; and in order to measure its importance and to trace the prominent part in connection with it, which has been assigned to the Board of Works, it will be necessary to survey briefly the various measures relating to the subject, which Parliament has at different times promoted.

In 1831, the Act 1 and 2 William IV., c. 57, commonly known as "More O'Ferrall's Act," was passed. The primary purport of this Act was to enable landed proprietors to constitute themselves into joint stock companies, and to proceed with the execution of drainage works, without the intervention of a private Act, but by private agency and with private funds, independently of the Board of Works.

Little practical result having followed this measure, Parliament endeavoured to find some more practical means for encouraging works of this description. Accordingly in 1842, another Act (5 & 6 Vict., c. 89) was placed on the statute book, which provided that the Government might, on the application of the owners of two-thirds in value of the lands proposed to be improved, carry out, by means of skilled professional officers, under the superintendence of the Board of Works, drainage works, and where desirable, drainage works in connection with navigation. It intended that private funds should still bear the main cost of the works, but did not exclude the Government from being one of the subscribers on the security of the improved value of the land. On the undertaking being completed, the expense was to be apportioned on the lands drained, according to the benefit conferred; and the works were to be handed over for care and maintenance to a local body of Trustees.

During the next three years, however, notwithstanding these great facilities, drainage work progressed slowly. Then came the disastrous famine years. There immediately ensued a demand that means should be found for the employment of labour to alleviate the wide distress. If such means were to be supplied by the Government, they were bound to be directed to reproductive works; and the choice fell on Arterial Drainage. With a view of meeting the urgency of the case, the Government obtained fresh Parliamentary powers, temporarily, under 9 Vic, c. 4, which enabled it to dispense with the obligation of the payment of preliminary expenses, and to proceed with such works, through the instrumentality of the Commissioners, on its own responsibility, with the consent of the proprietors of but one half in value of the district, provided only the expenditure did not amount to more than £3 per acre. Any excess on this required the second assents of the proprietors.

These works were now universally undertaken, and in order that the necessary funds might be supplied, the State was obliged to make extensive use of its lending powers.

After the famine was over the Government became alarmed at the outlay. They directed every exertion to be made to close the works, and a return to the ordinary procedure under the Act of 1842. Complaints soon followed from proprietors that, owing to the distress among the labouring classes, they had schemes forced on them—that, owing to the incompleteness of some of the works, their lands were still flooded and had derived no substantial benefit from the outlay—and that in other cases owing to extensive deviations from original plans and estimates, about which local interests had not been consulted, they found themselves charged with expenses which, with so general a depreciation of rents, they were unable to meet. Extensive remissions, on the recommendation of the special Commissioners appointed in pursuance of the Act 16 and 17 Vic., c. 130, were the natural consequence.

New works were practically suspended after the famine time. This was to be ascribed partly to funds not being forthcoming, partly to the comparative difficulty in procuring labour, and partly to the apathy of proprietors after the great exertions they had made during the crisis. For some years, in fact, the duties of the Board of Works, in connection with arterial drainage seem to have been practically confined to completing the works already commenced, to making the final awards, and to giving information and advice to trustees to whom the works were being gradually handed over.

In 1862 the importance of providing further means for prosecuting arterial drainage forced itself on the attention of the Government. The result was the passing of the Act 26 & 27 Vic., c. 88, in the following year. This Act was framed in great measure on the basis of the English Drainage Act of 1861 (24 and 25 Vic., c. 133). It relieved the Government of the responsibility of executing any works by its own employés. Its aim was to leave the initiation of drainage schemes entirely to proprietors, and to enable them to carry out their works with less amount of official control and interference. At the same time it placed at their disposal the advice and experience of the Board of Works, and the assistance of public loans.

We shall briefly describe the present working of this Act, as amended by subsequent statutes* which have been from time to time passed, generally at the instance of the Commissioners, with a view to extending the advantages of the original measure.

We suppose certain proprietors are desirous of improving their lands by arterial drainage. The first step they have to take is to forward to the Board of Works a statement of their requirements, accompanied by details, such as plans and estimates, and a schedule of the proprietors, with an outline of the effect of the scheme. Duplicate documents are deposited in the district for inspection, and notices are sent to the local newspapers and to the persons concerned, in order that objections may be lodged with the promoters. After a short interval, the Commissioners send down an Inspector to make inquiries, hear objections, and revise the estimate. This gentleman is not an officer responsible to the Board, or for whom the Board are responsible except as to his competency. He is merely appointed by them as occasion arises. His report is sent to the Dublin Office, and copies of it are furnished to the proprietors who are now given another opportunity of objecting to the scheme. If whatever objections are made are satisfactorily disposed of, and the Commissioners see no glaring defects in the scheme, they proceed, on receiving the requisite assent of the proprietors of two-thirds in value of the land, to make a Provisional Order, constituting the area into a drainage district, and in due course to obtain an Act of Parliament confirming the Order.

The Drainage Board are now in a position to commence the works and to borrow the necessary funds from the Commissioners of Public Works. The money is issued in instalments; and before making each issue, the Commissioners require to be furnished by their own engineer with vouchers of expenditure. The lands do not become liable for the repayment of the advances till the works are completed, and the award charging the amount expended is finally made; but interest at the rate of 4 per cent. is charged from the date of the advance, and is added to the gross sum issued. The repayment when due (including the interest that has accumulated in the interval) is provided for by a rent-charge covering interest as well as principal. If the improvement proves sufficient the charge is at the rate of £6 10*s.* per cent. for 22 years. If the benefit derived falls short of that sum, the charge is reduced to 5 per cent,, and is spread over 35 years. The duties of the Board of Works, subsequent to this stage of the proceedings, are confined to progress inspections, to the recovery of the money, and to dealing with applications from proprietors for determining the amount of increased rent to be paid by tenants.

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* 27 and 28 Vic., c. 72 28 and 29 Vic., c. 52; 32 and 33 Vic, c 72; 35 and 36 Vic., c. 31, 37 and 38 Vic., c 32.

(Extracts from Mr. LeFanu's Evidence before the Committee).

1881. Chairman (Lord Crichton).—It is not likely you would get the consent of two-thirds of the proprietors where it was not considered desirable to go on with the work?—I think not.

1882. Mr. *Kavanagh.*—Would you consider yourselves justified if they guaranteed the repayment of the loan to still refuse them because you believed it would not pay even supposing they were willing to bear the loss?—We would not if the work was in progress and good would be effected, even although we represented to them when they applied first for a supplemental loan, that it would not pay. They sometimes say, as in the case of the Inny some time since "we prefer going on; we are willing to suffer loss, and we will go on." It being such a case—a case of considerable improvement to the country—we gave the additional sum required. But a question would arise upon that afterwards. It would not be right that we should put on the tenants more than we really thought the tenants were benefited by the improvements, so that in that case the tenant would not suffer any loss. It would be the landlords, the proprietors, who had initiated the district, and had begun all proceedings and done the work themselves, who would suffer the loss by reason of having gone on with the work in a district which was not a paying one. The tenants would not suffer. After a district is completed any landlord can arrange with his tenants the amount of the rent they should pay. If they do not agree, any tenant who is not willing to pay the amount sought to be obtained, or the landlord may make an application to us to fix the rent. We then require that the tenant shall have obtained ample notice, but there is hardly ever a case in which the tenant applies. The landlord must show us that every tenant whose rent is to be raised has been served with notice of the application. A day is fixed and the landlord and tenant have to attend and the rent is fixed by us. The other day we had about twelve tenants who fought hard against the landlord. In that case I fixed the rent I thought fair. I may say that I believe that if the tenants are fairly dealt with they are always satisfied. There are two cases of Lough Erne waiting. Both are for the same scheme but on different plans. We had nothing to do but investigate both reports and send the reports in each case to the proprietors, with forms of assent, saying, if you get the forms of assent signed we cannot make two provisional orders constituting the same district We should have to decide between them, but the question has not arisen, because neither has got the required assent.

Engineering Inspection.

1898. Mr. *Henry.*—Do you think, Mr. LeFanu, it is a just thing that the cost of the inspector appointed by the Board of Works to examine the plans submitted by the proprietors, in drainage districts, should fall upon these proprietors?—I think it is taking the view I have always taken of the Act—that the object of the Act was to relieve this Board of all responsibility. If we pay the officer he is to a certain extent our officer; that would put him somewhat in the position of being our officer, which I think it was intended he ought not to be.

Board's Responsibility under the Act.

1899. Mr. *Henry.*—As regards the proprietors of lands being alone responsible under this section, to which I direct your attention, the Board of Works are to appoint an inspector and he goes down to the place, "and having considered all such objections as aforesaid, he shall cause such alteration (if any) as he may deem expedient to be made in the said schedules, maps, plans, and estimates, and he shall sign the same, and such schedules, &c., shall be preserved by the said Commissioners in Dublin." Well, then, is it not the case that the inspector of the Board of Works does, upon his own authority, make such alterations in the estimates and plans as may seem fit to him?—Quite so; he is an inspector appointed by the Board of Works. He is not an officer of the Board of Works, just as the Board of Works appoint an arbitrator in other cases, but they are not responsible for him. He is not an officer of the Board of Works.

1900. Mr. *Henry.*—But is not the Board of Works responsible for the efficiency of the arbitrator?—I think so. We would be quite responsible for having appointed a man fully qualified for the work. He is not an officer, and this inspector is appointed just as the arbitrator is. We might appoint an engineer of our own if there was a sufficient number, but it would not be desirable to do so.

1901. Is he not appointed as an officer of the Board of Works *ad hoc*?—No, he is not an inspector of the Board of Works. The Board of Works are merely authorized to appoint him as they would an arbitrator.

1902. Mr. *Henry.*—Do not the Board of Works appoint him because it is impossible for the Commissioners themselves personally to do the work? Does he not present a report to the Commissioners, and do the Commissioners not revise his plans in consultation with himself?—Oh, never. We never revise his plans. We never meddle with his decisions at all. Before we make a provisional order we go carefully through the whole case, and if it is a proper case to make a provisional order we do so, but we never touch his estimates or interfere with his plans.

1903. But if you see something objectionable in his plans do you not speak to him about it, and get his plans altered if necessary?—I think we would be very slow to interfere with him. If he is really a competent man I think we ought not interfere with him; as there is notice given for two months of the lodgment of these plans everyone can examine them. They can employ engineers to examine them if they like, and every objection that is made is heard, and I think the less we do in the carrying out of the Act, and in the actual preparation of the plans or the carrying out of the work, the better.

1904. Mr. *Freemantle.*—In fact the engineer employed by the Board is merely an independent authority upon whose judgment the Board can act?—On whose judgment the proprietors in the first instance can act, and upon whose plans the Board may make a provisional order, if they think that his scheme and plans and estimates are satisfactory.

1905. Are these works done by contract?—Yes, as far as possible. In some cases they are not, but we always insist on their being done by contract if possible. The contracts are necessarily on divisions of the work, and in some cases there were instances where the contractors failed.

1906. And is that the reason why the estimates are exceeded in some cases?—The large increase was owing to the failure of contractors in some cases.

1907. Of course the contracts are entered into by the Drainage Board?—Yes.

1909. To relieve the Board of all responsibility of initiating measures?—Yes.

APPENDIX No. 2.

River Drainage, under the Acts 5 & 6 Vict., c. 89—8 & 9 Vict., c. 69—9 Vict., c. 4—and 10 & 11 Vict., c. 79.

LOUGH ERNE DISTRICT, COUNTIES OF FERMANAGH, CAVAN, MONAGHAN, AND DONEGAL.

REPORT BY MR. WILLIAM FORSYTH ON THE DRAINAGE OF THE LANDS IN THE ABOVE DISTRICT.

DRAINAGE OF THE FLOODED LANDS.

SITUATION, GENERAL FEATURES, AND EXTENT OF RAIN BASIN OF THE DISTRICT.

LOUGH ERNE is one of the largest and most beautiful lakes in the kingdom, and forms a magnificent natural recipient of the drainage water of an extensive and highly-diversified country. It occupies a central position in the county of Fermanagh, dividing it throughout its entire length from south-east to north-west; and is richly studded with numerous islands, many of them highly cultivated, and ornamented with valuable timber. Its greatest length in a straight line is thirty-two statute miles, and its greatest breadth seven miles. It is separated into two expanses of unequal areas, distinguished as the Upper and Lower Loughs, which are connected by eleven miles of winding river-course.

The country by which it is surrounded presents features varying in character from fertile flats, but little elevated above the level of summer water, to steep slopes ascending into mountains of considerable height, or bold cliffs rising abruptly from the water's edge. The shores of the Upper Lough are generally low, and extend into expanded tracts of rich pasturage, or moors and valuable turbaries, succeeded by highly-cultivated lands sloping up gradually to the mountains by which the basin is bounded. Much of the lands adjacent to the connecting river and Lower Lough rise more suddenly, and are under cultivation from the water's edge.

The catchment, or rain basin, includes the whole of Fermanagh, and part of Donegal, Tyrone, Monaghan, Cavan, Longford, and Leitrim, comprising within its boundary an area of 1,521 square miles, or 973,440 statute acres. The surplus or drainage water of this extensive basin is principally conveyed into the lough by the following rivers.

The Upper Erne, which commences in Lough Gowna, is situated on the confines of Longford and Cavan, and after a short course expands into the irregular sheet of water called Lough Oughter. It is joined in this lough by a large river which rises on the confines of Longford and Leitrim; and by the Annalee, another large river which takes its rise in the south-western parts of Monaghan, and entering Cavan in two streams which unite near Cootehill, it receives the tribute of the Modnbawn, Laragh, Bunnoe, Cavan river, &c., and falls into the Erne near the ruins of the old church of Urney. The Erne, after its issue from Lough Oughter, flows in a northerly direction past the town of Belturbet, and falls into the Upper Lough near Crom Castle.

The Woodford river takes its rise in the mountains which intersect Cavan and Leitrim, between the Erne and Shannon, in numerous small streams, which, united, form the Aghacashlaun river, the Yellow river, and Blackwater tributaries. These again become united in one channel at Woodford, from whence the river takes its name; it then flows eastward past the town of Ballyconnell, and falls into Lough Erne on the westward of Crom. The Rag river, which drains the flat country south of Ballyconnell, falls into the Woodford river near its entrance into the lough.

The Claddagh, or Swanlinbar river, which has its principal sources on the southern side of Cuilcagh mountains and the northern slopes of Slieve Rushen, in the county of Cavan, and flowing eastward, falls into the Upper Lough near its northern end.

The Arney river, which commences in Lough Macnean, at the junction of the counties of Fermanagh, Cavan, and Leitrim, and flowing eastward near Florence Court, falls into the western branch of the river connecting the lakes at Rossdoney.

The Sillies river, which rises in Meenameen Lough and Lough Naman in the parish of Inishmacsaint, and the two branches uniting in Carrick Lough, flows in a general south-easterly direction, passing Derrygonnelly, to Drumrainy bridge; it then changes its course to the north-east and falls into the River Erne at Rossorry, near Enniskillen.

The Finn river takes its rise in the Carnmore mountain, county of Monaghan, and flows southward past the town of Rosslea, winding its course along narrow valleys, enclosed by high lands, to Stone bridge. It then enters a more open country, and being joined by the Skeagh river, which rises in the eastern parts of Monaghan, it passes under the Ulster canal at Conaghy. After passing Anlore bridge it changes its course to the westward, receives the Knockballymore river, and finally falls into a branch of the Upper Lough at Wattle bridge.

The Hollybrook river rises in the mountains above Lisnaskea, and flowing westward, falls into Kilmore Lough, and thence by a short course to Lough Erne at the embouchure of the Colebrook river.—See diagram map.

The Colebrook river has its source in the Carnmore mountain, county of Monaghan, and flowing westward, it is joined by the Cooneen water, which rises in the same mountain, and by the Cleen river, which rises on the confines of the counties of Fermanagh and Tyrone. Passing through the Colebrook and Ashbrook demesnes, it is joined by the Many Burns river, and, changing its course to the southward, and passing the town of Maguire's bridge, by the Tempo river—both of which take their rise in the mountains on the confines of Fermanagh and Tyrone, north of Five-mile-town,—it is also joined by the Aghavae river, which drains the country near Brookeborough, and ultimately falls into the Upper Lough Erne near Kilmore Lough.

The Bellanamallard river rises in the western part of Tyrone, and flowing westward through the town of Bellanamallard, falls into the Lower Lough at Saint Angelo.

The Kesh river has its source in the Tappaghan mountain, near the north-eastern point of Fermanagh, and flows in a westerly course past the village of Ederny and the town of Kesh into the Lower Lough about a mile below the last-named town.

The Termon river, which takes its rise in the Crockkinuagoe mountain, county of Tyrone, flows southward, passing the town of Pettigoe, and falls into the lough at its most northern point.

The Bannagh river, which rises near the boundary, between Fermanagh and Tyrone, and flowing in a south-westerly direction, falls into the lough at Portnode.

In addition to these large rivers, there are many smaller ones and streams, too numerous to be noticed particularly, which enter the lough on all sides, and carry into it the drainage water of their respective catchments.

The surface of the lough is much raised periodically by the floods discharged into it by the foregoing rivers and streams, and by the drainage of its own immediate catchment basin. These elevations of the surface level are the causes of very great injury to a large territory of land, equal in value to any in the kingdom. Much of the low lands adjacent to the Upper Lough, where the floods rise highest, are subject to injurious inundation for several months every year. A principal object of the present inquiry being to ascertain the causes of these injurious results, and the means to be adopted for removing them, a more detailed examination is necessary.

IMPEDIMENTS TO DRAINAGE.

The Upper Lough is so thickly studded with islands, that it has been said, it bears more resemblance to a flooded country than a spacious lake. Its surface is subject to frequent and great variations in winter or wet seasons, arising from the disproportion between the supplies of its tributaries and the discharging power of the channel connecting it with the Lower Lough, until it is raised several feet above the level of the adjacent low lands, and its area nearly trebled in consequence of the large territory thus submerged.

The immediate cause of the disproportion between the discharge and the supplies, is the inadequacy of the river channel between the two loughs, in its present state, to carry off the effluent water at or near the medium summer level. It is divided into two branches or channels through a great part of its length. The western channel commences near the north-west point of the lough, between Innishmore and Corracoash on the mainland. The first impediment or shoal occurs near the confluence of the Arney river, and is divided into two ridges or barriers crossing the channel about 150 yards apart. It is composed partly of the deposits of the Arney, and partly of diluvial clay and stones; the least depth of water at medium summer level is about three feet. Another small ridge or shoal crosses the channel at Derrycramph, composed of clay and stones.

About 300 yards below Innishmore ferry the two branches are connected by a deep channel which separates Innishmore from Knock island. The western channel between Knock island and Cloonatrig on the mainland, does not exceed seventy feet of average width, and it is crossed by the shoal called the Black Rocks, consisting of masses of detached limestone overlaying the solid rock. Many of the large blocks formerly resting on this shoal have been removed by a committee of private subscribers, called the Erne Navigation Company, under the direction of their engineer, Roderick Gray, Esq., C.E., of Enniskillen, and there is now a depth of from five to six feet of water below ordinary summer level. The two branches communicate again between Knock island and Cleenish island; at the north-western point of Cleenish they become united, and the river winds round the high land of Ring in one channel of great capacity.

The eastern branch leaves the Upper Lough near Belleisle demesne, and the first obstruction occurs at Carry bridge. A large shoal crosses the channel, on which the old Carry bridge stood; the old bridge has been wholly removed, a new bridge has been erected, from the designs of Mr. Gray, of three arches or openings; the two side openings are spanned by semicircular arches of twenty-five feet chord, and the centre opening is forty feet in width, covered, for the present, with a timber roadway, there being some intention of replacing it with a cast-iron swivel arch, the piers being designed so as to admit of the change. The structure is of superior masonry, and has a handsome appearance, but more waterway would have been essential. The foundations have been laid at a low level, with a view to the future improvement of the channel by deepening. During the last summer the two side arches were dry, and the stream under the centre opening only a few inches in depth.

The next shoal occurs on the east side of Knock island, below the first communication between the two branches already referred to. It consists principally of diluvial clay and boulders, and of some rock; the depth of water in summer is about four feet. With the exception of those two shoals, the eastern channel is of considerable depth. After the junction of the two branches north of Cleenish island, the river flows in one channel to Inishkeen island which separates it again into two branches, but at the north end of the island they re-unite.

The next shoal is that on which the Scarlet, or Dane's eel wears formerly stood, and it is very extensive. A navigable channel has been excavated through it by the Erne Navigation Company, but the river channel is here much contracted, and the depth of water over a great part of the shoal being very small, the excavated channel has produced very little change in the rise of the floods, which this winter have risen eight feet nine and a half inches or to within two and one-half inches of the greatest height on record. The material of which the shoal is composed is clay, gravel, and sand.

The river is divided into two branches at Enniskillen, by the island on which the town is principally built. The western channel is the most important; it is crossed by a handsome bridge of three arches, affording a clear waterway of 136½ feet. The depth of water on the shoal on which the bridge stands is about two feet in summer, except under and in a line with the western arch, where a channel has been excavated by the Erne Navigation Company to the depth of seven feet.

The eastern branch is crossed by an old bridge of five arches, having 116 feet of clear waterway. The depth of water on the shoal on which this bridge stands is only a few inches in summer, except a narrow channel under one of the arches. It is succeeded by another shoal called Boston's Ford, which in summer has only about two and one-half feet depth of water over it. The two branches unite below the military barracks, where the water becomes deep and expands into the resemblance of a small lake.

Recent encroachments have been most injudiciously made on both channels, highly injurious to the discharge of the floods. At the north-western corner of the west bridge a circular building, succeeded by a wharf wall, projects into the channel, covering a large portion of the western arch, and, where freedom from obstruction is so essential, impeding the velocity of the current, by presenting a direct opposition to the stream. Buildings projecting into the channel have also been erected on the east or opposite side, but this, from its position, is the most injurious. Encroachments have in like manner been made on the eastern channel, by which the breadth is reduced to twenty feet less than the clear waterway of the east bridge, about 100 feet down stream from it. These encroachments, so prejudicial to the discharge of the floods at this important point, are matter of regret, as it would have been most desirable to preserve the channels, naturally confined, free from any obstructions whatever.

The last shoal before entering the Lower Lake is at Portora. The river is much contracted here, and the banks are high; it is chiefly composed of limestone rock, with a partial covering of clay and gravel. The depth of water in summer is about four to five feet, and the bottom very irregular, being a succession of pits, or pools and shallows. The cause of the irregularity in the bottom and the existence of so many pools is, that stones for building purposes have been quarried here.

The Lower Lough is of much greater extent than the Upper Lough, and the depth in some parts upwards of 200 feet, being fifty feet below the level of the sea at low water of spring tides.

The Lower Erne river issues from the north-western point of the Lower Lough, at Roscor, about three miles from Belleek. The depth of the water decreases much towards the entrance to the river, except a narrow winding channel, averaging from eight to ten feet; but in a direct line the depth is much less. The efficiency of this reach of the river, as an outfall of the effluent waters of the lough, is greatly lessened by two very extensive shoals, besides several minor ones.

The first shoal is that on which the Corrakeel, or Dundas's eel weir stands. Its total length is about a mile and a quarter, and the depth of the water at the eel weir about one and a half feet, except in the fishing eyes and the sailing channel on the north side. It is composed of clay, gravel, and limestone rock. The rock is of variable quality and much divided by beds of shale; but in parts it is more compact. The wings, or arms of the eel weir, are composed partly of stakes and skaes, but chiefly of stone walls, with a watch-house reared on a mound of stones. The arms of the eel weir rise as high as the flooded bottoms near Enniskillen, and within one foot of the level of the low meadow lands near the Upper Lough, and altogether oppose, most injuriously, the discharge of the flood-water—raising a head, varying from a few inches to nearly two feet, according to the state of the floods.

The last shoal requiring a particular notice is that at Belleek. It consists of compact limestone rock. The river is divided into three channels of different capacities by two islands, but reunites, and retaining the full breadth until it approaches the summit of the rock, which rises as a natural weir, the water is discharged and precipitated down the falls to Belleek bridge, where it is confined in a narrow channel of about thirty feet and of great depth. The depth of water passing over the rocky barrier, or natural weir, in summer is only a few inches; but in winter it increases to from three to four feet. This increase in winter is assisted by the eel weir erected on the summit of the rock, which embraces about two-thirds of the entire width. The wing wall of the eel weir is built of loose stones of sufficient thickness to resist the force of the floods, and part of it rising to their highest level, which corresponds with that of the low meadow lands adjacent to the lough.

The water is diverted on each side of the fall by stone walls, or mounds, to supply power to two mills. That on the south side has two small water-wheels, which drive a pair of stones, each for grinding corn; that on the north side has a water-wheel and machinery of a superior construction, drives two pair of stones for grinding corn, and has machinery attached for sawing timber.

PROPOSED IMPROVEMENTS.

It appears that the improvement of Lough Erne has long been an object of much solicitude with the landed proprietors of the county of Fermanagh, especially those whose properties are situated contiguous to it, and suffering much injury from its periodical overflowings. It is, however, impossible to form any opinion of the views entertained, or the extent to which it was proposed to carry them out, so far, at least, as drainage was concerned, as I have not been able to procure any document on the subject except the report of Thomas Rhodes, C.E., made in the year 1840. Mr. Rhodes not having furnished the data on which his propositions were based, the navigation of the lake seems to have been his principal object, and the improvement of the drainage of secondary importance only.

Before proceeding to describe any plan proposed for the removal of the impediments to the free discharge of the flood-waters, without injury to the low lands, or to the free navigation of the lake, throughout its whole extent, it is necessary, as far as circumstances will admit, to ascertain the quantity of flood-water to be passed off, and the available head under which it must be discharged. I beg here to remark, that if this course had been adopted by former engineers, who have reported upon Lough Erne and proposed plans for its improvement, it is very probable that less difference would have been found in their various projects, and that they would have approached nearer what the difficulty of the case demands. If the lake had been one extended basin, without any intermediate contraction, the course to be pursued would have been much simplified; but being divided into the Upper and Lower Loughs, with about eleven miles of river-course between them, it becomes necessary to treat them in succession.

The Upper Lough is the recipient of the surplus water of a rain-basin of 1,189 square miles, or 760,960 statute acres. The fall of rain varies much in different parts of this extensive basin; it has, however, been found by observation, that it is no unusual occurrence for two inches in depth of rain-water to fall in twenty-four hours; but an instance has not occurred in which that quantity has fallen for any number of days successively. Without entering into a minute investigation of this subject, it is deemed sufficient for the present purpose to assume that two inches, in twenty four hours, do fall occasionally throughout the entire basin. It is generally admitted that not more than one-fourth of the rain falling on the surface of the earth, is ultimately discharged into the sea; and the proximity of Lough Erne to the harbour of Ballyshannon is such, that it may be assumed, without material error, as being the quantity arriving in the lake.

The area of the Upper Lough, as given by the Ordnance Survey, is 9,453 statute acres; but several contiguous loughs, having immediate connexion with it, are not included in the measurement; if these be added, it will increase the area to about 12,000 acres. The area of the lough is therefore only about one sixty-third of the catchment basin, which accounts for the rapid rise of its surface in the winter season, and creates the necessity for capacious channels to carry off the influent water, if its surface—to prevent inundation—be kept below the level of the low lands.

If one-fourth of the rain-water falling within the catchment basin in twenty-four hours, as stated above, drained immediately into the Lough, it would average about 960,000 cubic feet per minute; and provision for the discharge of that quantity, under a small head, would be absolutely necessary to prevent the sudden rise of its surface. This, however, is not the case. Several of the largest rivers traverse a great extent of country before they deliver their tribute of flood-water into the lough; and, in addition to this, at several points in their course they expand into large loughs, which in various degrees, proportionate to their areas, operate as compensation reservoirs, and retard the ultimate arrival of the flood-water in Lough Erne.

The Upper Erne takes its rise in Lough Gowna, having an area of about 4,000 acres, which receives the drainage of about 100 square miles, and delivers it out slowly. After a short course it again expands into Lough Oughter, having an area of about 5,000 acres, where it receives the Killeshandra river and the Annalee river, which have undergone a similar process in their courses by passing through large loughs. The Woodford river has three large compensation reservoirs, proposed to be further improved by art, besides smaller ones. The Arney river has also its compensator in Lough Macnean, which receives the drainage of a large part of its catchment, and delivers it out slowly. These rivers drain about two-thirds of the catchment of the Upper Lough; and it is observed, that from two to four days elapse, after the falling of the rain, before their floods produce much effect upon Lough Erne.

The Finn, the Swanlinbar, the Hollybrook, the Colebrook, and several smaller rivers have no such compensators, and their courses being shorter and more rapid, they pour the supplies of their respective catchments into the lough in a much shorter time, which are in a great measure passed off before the arrival of the floods of the before-named rivers. It does, however, occasionally happen, that the floods of the last-named rivers, caused by a subsequent fall of rain, meet the retarded floods of the former in the lough, and when this takes place the advantage is nearly lost.

Still however observation proves, that the calculated produce of the catchment in twenty-four hours, under the most unfavourable circumstances, occupies a much longer period than that in its arrival at the lough. From the registries of the daily rise and fall of the surface of the Upper Lough, which have been kept for this inquiry, and which show its varied phases during two seasons, it appears that the surface, uninfluenced by wind, does positively rise ten inches in twenty-four hours—but in two instances only, one in each season. A remarkable feature in the greatest rise is, that they occur when the floods have obtained about half their greatest height, proving that such an accumulation of flood-water does not take place until the earth has been fully saturated by continued rains; and that when the surface has obtained a greater height, the discharge approaches nearer the influx, and the daily rises become proportionally less.

This fact ascertained is of use in designing plans for the regulation of the lough's surface. From the respective levels of the water's surface in summer and the low lands it is ascertained, that when the lough is raised about three feet above the summer level by floods, its area will be doubled nearly, or about 24,000 statute acres. That area at ten inches deep, added to the actual discharge, will give a quantity under 700,000 cubic feet per minute, and not 960,000, the calculated quantity as above to be discharged, if the fourth part of the rain-water came down in twenty-four hours. In each of the two seasons, during which the registries have been kept, a rise of this amount having taken place, it is presumed that such rises do generally take place in the wet season of the year, and that provision must be made for the discharge of that quantity, under a head *below the level of the low lands adjacent to the lough*, to secure them against inundation.

Having ascertained the actual maximum quantity of flood-water to be discharged in a given time, the next inquiry is the available head with a channel eleven miles long, coming within a reasonable cost of formation.

Much has been said about "a uniform level." I have carefully perused what has been written on the subject, and collected information from every available source; but I have not in a single instance found even an attempt made to furnish data on which to base such a proposition, and I venture temperately to affirm that to maintain a uniform level at all times of the year from Crom Castle to Belleek, without either ruining the navigation in summer, or submerging the low lands in winter, is wholly impracticable within a reasonable outlay. Much difference of opinion has also arisen from the apparent discrepancies in the difference of level between the two loughs, as stated by several parties in their reports; this has in a great measure arisen from overlooking the physical causes affecting the levels of their surfaces. A positive difference in the respective levels of the two loughs will occur in the short time necessary for the operation of levelling between them, and unless the variations be duly corrected perfect accuracy will be unattainable. Unless the levels be taken by different parties, under precisely similar circumstances, the results will vary.*

The levels for the present inquiry were taken during the summer of 1846; and to prevent error as much as possible, bench-marks were fixed at Portora Castle and Portreagh, opposite Creaghan point, and a chain of pegs driven intermediately. The levels were then carefully taken, and repeatedly checked in both directions; the difference of level between the surface of the water in the Upper Lough and the Lower Lough was thus found to be six one-tenth inches. The difference of level in winter varies exceedingly from this difference in summer to thirty-three inches, the maximum difference observed; and a difference of level varying between these two extremes, according to the state of the loughs and the height of the floods, must necessarily take place to produce a head sufficient to discharge the flood-water by the river channel between the two loughs.

When the accuracy of calculations founded on legitimate data are confirmed by observation, they furnish a basis for a system of improvement suited to the exigencies of the case, without risk of failure or disappointment.

The area of the Lower Lough being so much greater than that of the Upper Lough, its influence as a compensator is much more effective. The area of the catchment basin draining directly into it, is less than one-third of that of the Upper Lough, while the area of its surface is nearly three times as great, and the river-course from Roscor to Belleek—the outfall of its surplus water—is little more than three miles, therefore a smaller rise of its surface level creates a fall amply sufficient for the augmented discharge. This accounts for the disparity in the rise of the two loughs, respectively, and the continual variations between their surface levels; the relative rises being very nearly as one and a half to one during the winter season, but at other times they are more arbitrary.

The produce of the catchment basin of the Lower Lough appears, by the same process as explained above, to be about 270,000 cubic feet per minute. The flood-water of the Upper Lough, occupies at least twelve hours in its journey by the river-course between it and the Lower Lough; and the rain-water of the catchment basin of the Lower Lough being discharged almost immediately into it from the precipitate nature of the catchment basin, will have passed off by the outfall before the arrival of the flood-water in any great quantity from the Upper Lough. This is more especially the case when sudden rises take place after excessive rains, which are seldom of long continuance without interruption.

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* It appears to me unaccountable how the difference of level between the Lower Lough and the river at Lisgool, amounting to two one-fourth inches, could be mistaken for the difference of level between the two loughs, when there is nearly eight miles of river-course encumbered by several shoals, between Lisgool and the Upper Lough.

There is perhaps, all things considered, seldom more water to be discharged at Belleek than what I have stated, as the maximum discharge from the Upper Lough; but to guard against error, I assume that the greatest quantity to be provided for is 800,000 cubic feet per minute, and observation proves that it seldom, if ever, reaches that maximum. This influx into the Lower Lough would raise its surface twelve inches in twenty-four hours, supposing no discharge from it took place; but if provision be made at Belleek for the discharge of 600,000 cubic feet per minute, it would require four days to raise the surface of the lough to that extent, proving its useful effects as a compensator.

It appears from the daily registries of the rise and fall of the lough, that from the 17th to the 21st November, 1846, the total rise in the Upper Lough was twenty-eight and a half inches, giving an average of more than seven inches per day. This is the greatest rise within the time that has been observed; and it may be remarked that the rise in the first day of the above period was ten inches, one of the two greatest observed. If the flood-water causing the above rise pass into the Lower Lough in the same time, and a discharge of 600,000 cubic feet per minute be provided for at Belleek, the surplus in addition to the produce of the catchment of the Lower Lough itself, would raise its surface twelve inches; or, in other words, the influx would exceed the efflux, by a quantity which would raise the surface of the Lower Lough twelve inches in four days. There being no instance of a similar rise in the same time since the registries have been kept, I have assumed it as being very nearly a maximum.

I am quite ready to admit, that it would be very desirable to maintain a "uniform level" throughout, and that there should be no interruption of any kind to the free navigation of the lough in every direction, but I affirm, that under these circumstances it would be highly impolitic. The property of fluidity does not release water from the inertia of matter in general, unless influenced mechanically by gravity or otherwise; therefore it would not flow along the channels of rivers unless a slope be formed on its surface, or in other words, there be a difference of level between any two given points in their length, and the velocity will be in proportion to the slope and the sectional area of the stream. It follows, that if there be a given quantity of water to be discharged, the capacity of the channel and the slope must be in proportion to that quantity, or if either of them be defined, the others must be in proportion thereto.

In the case under consideration there is, as already shown, nearly 700,000 cubic feet of water per minute to be discharged from the Upper Lough into the Lower Lough, by the river channel of eleven miles length which connects them; therefore, on the foregoing principle, there must be a capacity of channel and slope proportionate to that quantity. This is proved by the present state of things. The river channel is greatly deficient in capacity to discharge the flood water, with the average summer slope of six-tenths of an inch per mile; therefore the flood-water accumulates in the Upper Lough and along the river-course, until it attains a slope and capacity of channel proportionate to the discharge. This fact is in perfect accordance with the principle stated, and points out the legitimate course to be pursued, in the employment of artificial means to regulate the levels to be maintained.

I have ascertained that the river channel can, within the limits of reasonable expenditure, be deepened and improved, so as to make it capable of discharging the given quantity of flood-water under a head of three inches per mile, without raising the surface of the Upper Lough to the level of the low meadow lands. It is however evident, that if the Upper Lough be prevented from rising much above its summer level, and a slope of three inches per mile formed between the two loughs, the summer level of the Lower Lough must be somewhat reduced. I have already stated, that a great part of the Upper Lough, when at the summer level, is barely deep enough for navigation; it follows, that if the level of the Lower Lough be reduced to obtain the proposed slope to discharge the floods, and the surface has subsided to nearly a horizontal plane in dry summer weather, the depth of the Upper Lough would be so diminished as to injure the navigation most seriously. The entrance to the Woodford river, the Upper Erne river, and the Ulster canal, would, under these circumstances be also impracticable except after a great expenditure in deepening them. These untoward results, however, I mean to guard against by mechanical appliances, which shall be described in the proper place under the head of Navigation, page 26.

In describing the improvements and new works which I recommend for accomplishing what I have now discussed, I commence at the outfall at Belleek. I propose to reduce the rock at the top of the falls to 142 feet above datum (which is that of low water of spring tides at Ballyshannon), and thereon to construct a regulating weir, 810 feet in length, in the position shown on the enlarged plan of the place. The weir to be constructed of solid masonry, staunched with concrete and puddle, and divided into lengths by piers of ashlar masonry in three assemblages. The piers in each assemblage to be placed twenty feet apart in the clear, and the sills of the open spaces between them to be eight feet below the level of the coping of the solid parts of the weir between the assemblages. The number of these openings I propose to be seven, and in each opening to fix a hydro-anastatic sluice-gate—a modification of the sluice-gate known in America by the name of the "Bear-trap Sluice." The gates to be furnished with double-leaved valves of unequal areas, fixed in chambers connected with the head-water above the gates or weir, and with the outfall below the weir, by culverts constructed in the solid of the piers.

The head-water entering the first of the two chambers by the culverts, presses back the smaller leaves of the valves, and enters the conduits underneath the gates, by which means they are raised up to the level of the coping of the solid parts of the weir, which I propose to be 147 feet above datum, or very nearly the low summer level of the year 1847 at Belleek. When the head-water is raised by the floods, the water passes into the second chambers and presses on the larger leaves of the valves, by which the pressure on the smaller leaves is overcome, and the communication between the head-water and the conduits under the gates is cut off, and a communication from the conduits to the outfall opened, by which the water that sustained the gates is permitted to pass off, the gates then fold down level with the head-sills, and give free vent to the flood-water to pass off. When the level of the head-water falls to that of the solid weir, it ceases to enter the second chambers, and the pressure is removed from the larger leaves; the smaller leaves are then pressed back, and the water enters the conduits under the gates, by which they are again raised to the general level of the weir. The level at which the water enters the second chambers is governed by a movable gauge board, which can be set to the proper height; but to give complete control over the valves at all times, I propose that the shafts on which the valves revolve shall rise above the coping of the piers, and be furnished with capstan heads, or bevel wheels and pinions.

To afford access to every part of the weir at all times, I propose to raise the piers, and construct a light timber foot-bridge, to be supported on brackets over the solid parts of the weir, and trussed over the openings between the piers. As it would be difficult to explain the weir and sluice-gates in writing, so as to make them understood, I have submitted a model of a part, constructed to a scale of one inch to a foot, which accompanies this report.

I propose to flank the weir with wing walls of masonry; that on the south side to form a part of the head-race of the corn-mills, and a guard sluice, fixed in a line with the regulating weir, to prevent accidents from the failure of the fence wall of the head-race. The wing wall on the north side to form part of the head-race of the corn and saw mill, and of the navigation channel, should it be continued beyond Belleek; and to preserve or improve the water power of the corn and saw mill, if necessary, to lower the water-wheel and bring up the back fall which is abundant.

The eel weir, now occupying a site on the top of the falls, must necessarily be removed; but it may be reconstructed below the regulating weir. Proper passages for the migration of fish must also be constructed in the solid parts of the weir, and ascending approaches to them formed in the rock.

I propose to enlarge the three channels by which the water arrives at the falls, removing a part of the lower ends of the two islands, and of the low meadow on the north side next the town; to deepen the channels by excavation to a level 139·25 feet above datum, or eight feet below the top of the weir, which bottom level is to be continued into the lough at Roscor. The small shoals above Belleek to be removed, and the weir, called Dundas's weir, in the townland of Corrakeel, to be cleared away, and no part of it reconstructed, as any interruption to the free discharge of the flood water from the lough would be most prejudicial; the breadth of bottom through the excavations to be 340 feet.

The river channel at Portora shoal being deficient in width and the banks high, and as little addition can be made to the breadth, I propose that one foot be added to the depth, and that the bottom be 138 feet above datum; the breadth to be 200 feet. Any additional depth of excavation in this shoal is, as regards expense, to be regretted, as it will have to be made in compact limestone rock; but it is unavoidable, and the excavated stones will be available for building purposes; whereas, if an additional breadth be given to the channel, there would be a greater proportion of clay; but the adjoining ground is very high, and unfavourable for spoil banks.

The united breadth of the two channels at Enniskillen is liable to the same defect in breadth, and it is to be regretted that so many encroachments on both channels have been permitted. I propose, therefore, that the level of the bottom in both channels be the same as at Portora, and that the abutments and piers of both bridges be underset to correspond therewith.

At Dane's shoal the river channel being also much contracted, I propose that the same level of bottom be extended to this shoal likewise, and to increase the breadth by cutting off a portion of the two projecting points on the Drumsna, or west side, as shown on the plan of the survey; the breadth of bottom to be 210 feet. The shoals in both channels, at Enniskillen and this shoal, are very unfavourably circumstanced for ground whereon to deposit the excavated material, which will add to the cost.

The level of the bottom at the Black Rocks shoal, and upwards into the lough where excavation is necessary, I propose to be 142 feet above datum, or eight feet below the level to be maintained for navigation in the summer season. The shoal at Derrycramph and the shoals at the confluence of the river Arney, I propose to excavate to the full width of the channel.

The two shoals in the eastern channel at Knock Island and Cary bridge I propose to improve in a similar manner, by excavating them to the same level of bottom as in the western branch, and as to the full breadth of the present channel.

TRIBUTARIES.

The Upper Erne River.—The outfall of the loughs Oughter and Gowna, and river Erne district, is at Belturbet bridge. From Belturbet to Crom the distance is about seven statute miles by the line of the river, and this is the only part of the Upper Erne included in this district. The width of the channel generally is ample, if the depth throughout had been sufficient, but there are several shoals that greatly obstruct it—the small shoals at Belturbet and Pink Grove, which are principally of limestone rock; the Blocksom shoal, which is of much greater extent, is also composed of compact limestone rock, the depth of water in summer is from two to three feet. A channel has been partially made on the east side of the last shoal by the Erne Navigation Company, separated from the main channel by an embankment of clay and stones, for the accommodation of the navigation, but it is impassable by loaded trade boats at low summer water. Several small ridges occur at different places, and a shoal of considerable extent between Innishfendra and Gubb; it is composed principally of clay and gravel overlying the rock. The depth of water on this shoal during last summer was under two feet, and generally during the dry season it is used as a ford.

The Woodford River.—The terminus of the Ballinamore and Ballyconnell drainage and Junction Navigation district is at Aghalane bridge, and the remaining part of the Woodford river is in this district. From Aghalane bridge to Killynick the channel is encumbered with many small shoals and ridges of diluvial clay, and at the last-named place it is crossed by a considerable barrier of very hard clay mixed with boulder stones; the channel is then clear and deep to the embouchure into Upper Lough Erne, where there is a large shoal composed of clay mixed with boulder stones. The channel is divided into two branches by a small island, and the depth of water in summer is under two feet.

The Rag River falls into the Woodford river on the south side below the Killynick shoal. The floods of the lough extend their influence up this river to Drumrush corn-mill, a distance of four and a half miles. The channel is tortuous and generally small, the surface of extensive flooded meadows very little above the level of summer water, and shoals of rock and hard clay impede the discharge of floods independent of the backwater of the lough.

The Swanlinbar River.—The boundary of the district on this river is at Thompson's bridge. The course is generally clear and the channel deep, except a large shoal formed by the debris of floods at the embouchure.

The Arney River.—The boundary of the district on this river is at Drumane bridge. Several small ridges occur below the bridge, and at Rossdoney a large shoal exists just below the confluence of the Drumbughas river, composed of blue clay and gravel.

The Sillies River.—On this river the boundary is at Steenson's bridge. About a quarter of a mile below the bridge the channel is crossed by a ford, and the bridge of Gortadrehid is built on a large shoal; the depth of water under the bridge is only a few inches in summer.

The Finn River.—The proposed limit of the district on this river is Cumbor bridge. The channel of the river is generally of sufficient width, but it is greatly obstructed by shoals, especially at Anias bridge, Ballyhoe bridge, Gortnacarrow bridge, and Wattle bridge; the shoal on which Gortnacarrow bridge is built is composed of limestone rock. The adjacent meadows lie low, and are much subject to flooding. The Knockballymore river is tributary to the Finn, and productive of much injury to the meadow land, from their confluence to the aqueduct on the Ulster Canal, the channel being exceedingly crooked, and much too small for passing the floods.

The Moor Lough River.—The influence of Lough Erne extends up this river to the southern mearing of Keady; the channel has lately been much straightened, but it is still too small to contain the summer and autumn floods, which are the most destructive to the crops, and cause much injury to extensive and valuable meadow lands.

The Hollybrook River.—The boundary of the district on this river has been fixed at the ford in Clervaghy; the channel is exceedingly winding, and much choked up with sand brought down by the floods; and the meadow lands adjoining suffer very much from summer floods, which descend very impetuously, overflowing and destroying the grass with silt.

The Ballinamallard River, Kesh River, Bannagh River, and many more smaller rivers, have a much greater fall near the lough, and are less under its influence, but are encumbered with small shoals near their mouths that impede the discharge of the floods There is also a number of small streams and drains entering along the extended shores of the lake, especially the Upper Lough, far too great to be particularly noticed, much choked up and neglected, and greatly in need of improvement to fit them for carrying off the drainage-water with efficiency when the surface of the lake is regulated.

Proposed Improvements.

The Upper Erne River.—The shoal between Innishfendra and Gubb I propose to excavate to a level of bottom 143 feet above datum, the breadth to be 120 feet. The shoal at Blocksom's to be excavated to the same breadth and level of bottom, and the small shoals at Pink grove, Creeny bridge, and Belturbet lawn.

The numerous small streams and drains connected with this part of the river and neighbouring loughs, to be straightened and deepened to carry off the flood-water without injury to the low lands in which they are situated, as shown by red lines on the Ordnance Survey sheets of the district.

The Woodford River.—The shoals at Mullynacoagh, Killynick, and Aghalane, to be excavated to a breadth of thirty feet, and a level of bottom the same as the Upper Erne. The Rag river to be straightened generally, and deepened to seven feet below the low meadow land; the breadth of bottom to be twelve feet, at an inclination of about fifteen inches per mile, the side slopes one to one, and one-half to one, in clay and rock respectively. The three bridges crossing the river to be underset to the proposed new bottom. The small drains discharging into these two rivers, to be opened and improved to the extent of the flooded land.

Swanlinbar River.—The shoal at the mouth of the river to be removed.

The Arney River.—The shoals at Rossdoney and below Drumane bridge to be removed, and the entrance of Drumbughas stream improved.

The Sillees River.—The shoal at Gortadrehid bridge to be removed and the bridge rebuilt, the small shoal below Steenson's bridge to be removed.

The Finn River.—The shoals in the channel of this river to be excavated to a bottom level above datum of 143 25 feet from Lough Erne to Gubdoo lough, and 144 25 feet from thence to Cumbor bridge; the breadth of bottom, through the shoals at Wattle bridge and Gortnacarrow bridge, to be forty feet, and from Gubdoo lough to Cumbor bridge twenty-one feet, with slopes of two to one. The Knockballymore river to be straightened, and deepened to eight feet below the meadows, the breadth of bottom to be fifteen feet. The bridges to be underset to the depth of the proposed bottoms.

The Moor Lough River.—The parts not improved to be straightened, and the whole enlarged and deepened; the Bridge to be underset, and occupation bridges erected where they now exist; the drains to be opened to the extent of the flooded land.

The Hollybrook River—I propose to divert the course of this river by cutting a new channel from Garvaghy ford, along the mearing of Rosmacall and Kilmore South, into Kilmore lough, and abandon the present course between the Ford and Lough Head; the depth to be seven feet, and the breadth of bottom fifteen feet. An occupation bridge will be required between Rosmacall and Kilmore South.

The Colebrook River—The shoal at the mouth of the river to be cut through to give vent to the floods, and the smaller shoals to be removed. The Aghavea river to be straightened and deepened.

The shoals at the mouths of the Ballinamallard river, the Kesh river, and the Bannagh river to be removed.

The numerous small streams and drains discharging into the lough, which cannot be particularly named, I propose to open, straighten, and improve, as shown by a red colour on the Ordnance Survey sheets of the district, and to underset the small bridges and culverts, or rebuild them if found necessary.

NAVIGATION.

Before entering on the subject of the present project, I shall briefly notice the

Navigations connected with Lough Erne.

The Ulster Canal.—A connection by water between Lough Erne and Lough Neagh was long a desideratum: at length it was accomplished by the formation of this canal. It leaves Lough Erne near Wattle bridge, and passes the important and rising towns of Clones, Smithborough, Monaghan, Middleton, Caledon, Charlemont, and several of less extent, through a rich and well-cultivated country, and by the river Blackwater, which it enters near Charlemont, to Lough Neagh. The length of the canal is forty-eight miles, and the ascents and descents are accomplished by twenty-six locks. Its traffic is steadily increasing, but its objects will not be fully realised until the navigations now in progress of execution be completed.

It communicates through Lough Neagh with the Port of Newry by the Upper Bann river and the Newry canal, and with Belfast by the Laggan navigation. In a few years it will also have a communication with the Port of Coleraine by the Lower Bann navigation, which has been commenced under the Drainage and Navigation Acts, 5 and 6 Vict., cap. 89, and Acts amending the same.

The Erne and Shannon Junction Navigation—It appears from existing records, that efforts were made to promote the junction of these natural navigations by a canal at an early period. The late Mr. Chapman, C E., when practising professionally in this country towards the close of the last century, proposed to improve the Woodford river, and to connect the chain of lakes situated in the valley on the south of the Leitrim mouutains with each other and the Shaunon by a canal. Operations were actually commenced on a part of the river near Ballyconnell, but discontinued at an early stage of their progress.

A report was made by W. T Mulvany, esq., in the year 1838, by order of the Lords Commissioners of Her Majesty's Treasury, and laid before the Legislature. Nothing, however, was done until the proprietors of flooded lands along the line of this navigation, memorialized the Commissioners appointed under the Act passed for the promotion of Drainage and Navigation in the year 1843. The preliminary proceedings required by the Acts having beem completed, the works were commenced in 1846, and are now considerably advanced in their execution

On the completion of this canal, Lough Erne will be brought into connection with nearly all the inland navigations in the kingdom.

The Lough Oughter and River Erne Navigation.—The natural facilities for opening a navigable communication between Lough Erne and the central parts of the county of Cavan, seem to have been first brought prominently under public notice by Mr. Mulvany in his report on the Junction Canal, already referred to. The very irregular form of Lough Oughter affords singular facilities of access to a long line of coast, bounded by a fertile and densely populated country, in which the towns of Cavan, Killesbandra, Milltown, and Butler's bridge are situated. A memorial having been presented to the Commissioners of Drainage by the noblemen and gentlemen interested, in the year 1845, the preliminary proceedings were completed, and the works commenced in the following year, and are now in progress of execution.

BRIEF NOTICE OF FORMER PROJECTS FOR THE IMPROVEMENT OF LOUGH ERNE.

It appears that the navigation of Lough Erne engaged public attentian at a remote period, and was looked upon with especial solicitude by those more immediately interested; nor is this surprising, for it is a subject of such paramount importance that it could not well be overlooked by those acquainted with it, or in any way interested in its promotion. The spacious lough, lying as it does in the midst of the county of Fermanagh, one of the richest in the kingdom, presents a field for improved communication between every part of this fertile country, and by means of the navigations branching from it, with the great seaports and every part of the kingdom.

The earliest project for the improvement of this navigation, of which I have obtained definite information, was that which engaged public attention in the latter part of the eighteenth century, and for which the Government granted a sum of money. It was commenced under the direction of the late Mr. Chapman, C.E., in the year 1789, but in consequence of the disturbed state of the country in 1797 it was abandoned. I failed in procuring a copy of the engineer's report and estimate, or any authentic details of the plan except what the remains of the works partially executed afford. It would appear from the remains of the guard lock at Belleek, that the engineer intended to raise the level of the water in the river several feet, or that the level of the lough has been considerably reduced since that time, as the sills are placed only about three feet under the present level of summer water.

Notwithstanding the untoward abandonment of this project, the important subject was not lost sight of, and in the year 1812, the Directors-General of Inland Navigation instructed the late John Killaly, C.E., to make a survey for a line of navigation from Belleek to Ballyshannon, and to examine the principal impediments in the navigation of Lough Erne. In his report Mr. Killaly recommends to sink the shoals at Dundas's weirs, Roscor, Portora, Enniskillen, and the Scarlet, or Dane's eel-weirs. It appears that the improvements by sinking which he had in view were only very partial, as the amount of his estimate was but £2,000.

He concludes his report on the general project which he recommended, with the assurance that a navigation for vessels of forty tons burden might be opened from the sea to the southern extremity of Lough Erne; thereby diffusing the benefits of water carriage to an extent of sixty miles at least, and that it would make a junction between the Royal Canal and Lough Erne truly desirable (a project which engaged much of his attention, but which is now superseded by the Junction Navigation), and tend to excite a strong spirit for working the various mines that lie contiguous to that lake. It appears that Mr. Killaly reconsidered the project in 1831, when he confirmed his former views on the subject.

In the year 1832 the subject was again taken up in connection with the improvement of Ballyshannon harbour, and uniting Lough Erne therewith. A committee of the gentlemen of Fermanagh was formed, and a public meeting took place in Enniskillen, in the month of April of that year, but it led to no immediate practical results. Various subsequent meetings took place, and a variety of views were discussed, evincing the deep interest taken in the subject by the noblemen and gentlemen of Fermanagh.

In the year 1840, Thomas Rhodes, C.E., was instructed to examine the lake, and furnish a report and estimate. Mr. Rhodes submitted his "Report on the Improvement of Lough Erne for the rendering Navigable for Steam vessels and other craft, and for keeping the Lake at a more uniform level," dated the 13th of July, 1840, and accompanied by plans, sections, and estimates. He describes the deplorably imperfect state of the navigation to have been such, that it took boats containing only a few tons of goods upwards of a week to make the voyage of the lake, besides their having to be lightened at every shoal to enable them to pass.

The chief features in the plan proposed by Mr. Rhodes for accomplishing the object stated in the preamble of his report were the the construction of a regulating weir at Belleek, and deepening the shoals from Belleek to Roscor, at Portora, Enniskillen, Dane's weirs, Carry bridge, Black Rocks, Blocksom's, and some others, to a depth of seven feet below the level of low summer water, assuming that the difference of level between Belleek, and Belturbet, and Wattle bridge was only two and a quarter inches. The total amount of the estimate appended to the report for the execution of the work detailed therein is £29,797 1*s.*; but whether that sum included the purchase of dredging implements, the cost of superintendence, and contingencies does not appear, none of these important items having a place in the estimate.

Mr. Rhodes concludes his report by expressing his sense of the importance of the project in the following words:—"I am not aware of any project whatever where so much benefit might be derived at so small a cost, both on account of the drainage and navigation; and when it is considered that the Ulster canal is now on the eve of completion, which connects the Port of Belfast with Lough Erne, and the possibility of the junction canal, which will join Lough Erne with the River Shannon, being carried into execution, it will form a communication from the Atlantic to St George's Channel, and it is a work similar to the Shannon and next to it in importance, it well deserves the consideration of the Legislature, so as to put it in every respect upon the same footing with that great national undertaking."

At the public meetings which took place subsequently to the report being received, it was decided that a modified plan should be adopted in the first instance, but so arranged as to be a part of the complete design; and Mr. Rhodes was requested to furnish an estimate of the cost of forming a narrow channel sufficient to serve for the navigation alone, without reference to the drainage. Two estimates are furnished—one for a navigable depth of six and a half feet at summer level, amounting to £4,869 1*s.*; the other for a depth of five and a half feet, amounting to £4,025 11*s* 6*d*. The practical results were, that a sum of money was subscribed by the noblemen and gentlemen of Fermanagh interested, and the formation of the Erne Navigation Company, who chose Roderick Gray, C.E., of Enniskillen, as their engineer. Operations were commenced under Mr. Gray's direction, and a navigable channel has been formed by dredging and excavation at the West bridge of Enniskillen, Dane's weirs,—the eel weirs having been purchased and cleared away,—at Blocksom's shoal, and many of the detached blocks of limestone obstructing the channel at the Black Rocks have been raised and removed.

The benefits conferred by these improvements on the commercial interests of the country were speedily felt, and the trade of the towns contiguous to the lake rapidly increased. The enterprising Carrying Company of the Ulster canal placed a steam-tug on the lake, plying regularly between Wattle bridge, Enniskillen and Belturbet, and these towns and the surrounding country are brought into direct communication with the ports of Belfast and Newry by water-carriage, together with all the advantages of a facile, cheap, and direct means of commercial interchange of commodities.

I may further state that a strong proof of the utility of what has already been done, fully realizing the expectations of the promoters, was afforded during the late unprecedented circumstances of distress in which the country was placed, in the readiness and regularity with which foreign produce was brought into the very centre of this densely-populated country. So great was the pressure for several months, that scarcely any other commodity could be received for transport, all the resources of the Carrying Company being wholly occupied in this most essential department. It would be difficult for any one not resident in the district to comprehend the full extent of this public advantage; and it must be gratifying to the noblemen and gentlemen who so laudably promoted the improvement of the navigation without any direct profits to themselves, nevertheless, as a project of inland navigation, it must be considered a failure. Although the removal of Dane's eel weirs, and the excavation of a narrow channel through the shoal there and at the west bridge of Enniskillen, has not materially reduced the height of the floods yet the sectional area of the excavated channel bearing a very great proportion to the whole summer discharge of the river, it affects it most materially in summer or dry weather, rapidly lowering the level of the water's surface in the river and Upper Lough, until there is not a depth on the numerous shoals sufficient to float loaded trade boats over them. During the last two summers, especially the last, the steam-tug had not sufficient water for several months to float her over the shoals; and the trade boats, which occasionally made a few trips, carried only a few tons of goods. It is evident from the effect already produced, that if similar channels had been excavated in the shoals at Portora and Dundas's weir, very extensive cuttings must necessarily have been made in the shoals of the Upper Lough, the Erne, the Woodford, and the Finn rivers, otherwise the navigation would remain liable, even in a greater degree than at present, to be suspended for several months during the summer of each year; at the same time the navigation of the numerous small bays, inlets, and cuts along the shores of the lough so generally used for the transport of the country produce to market, would be wholly impracticable.

The reports and estimates referred to appear also to have been produced in haste, and in the absence of such an investigation as the importance of the case demanded. It is to be regretted that conclusions arrived at hastily should have been put forward with so much confidence, as at first sight it tends to embarrass succeeding projects—although made on legitimate data, resulting from a lengthened and careful investigation—by apparent discrepancies, especially in the estimated amount of the cost. If, however, the framers of these reports and estimates had the same opportunities of full investigation which I have had, I am persuaded the results obtained would have been very different, and such discrepancies in the plans and estimates would not have appeared.

THE PRESENT PROJECT.

Early in the year 1846 the Government, impressed with the importance of an improved inland navigation, and anxious to encourage and effectually assist the attempts making to carry improvements into execution, made a free grant of a moiety of the cost of the Ballinamore and Ballyconnell, the Lough Neagh, the Lough Corrib, and the Lough Oughter navigations, on condition that the drainage of the lands with which they are connected should be carried into execution. At the same time a sum of £8,000 sterling, as a free grant, was also given by the Government—equal to a moiety of the estimated cost—towards the execution of the proposed navigation of Lough Erne, on the express condition, that the proposed drainage of the flooded lands should be carried into execution in connexion therewith; which sum remains to be applied to this purpose, under the direction of the Commissioners for the execution of the drainage acts.

The principal promoters of the improvement, deeply impressed with the increasing demand for the completion of the navigation in a manner suited to its importance, applied to the Commissioners by memorial, dated the 24th day of April, 1846, praying that the navigation of Lough Erne may be improved in connexion with the drainage of the flooded lands, as the "navigation of said lake is of the greatest possible advantage as a national work, and well worthy of the attention of Government." The proposed works for the drainage of the flooded lands have been described above, and the project being a combined one, they necessarily include a large portion of those which would be required for the improvement of the navigation, if undertaken alone. I now proceed to describe the works that are more especially peculiar to the navigation.

I have stated above that I propose to guard against lowering the Upper Lough in summer, so as to interrupt the navigation, by mechanical appliances. Instead of an "uniform level" throughout I propose that there be one level reach from the regulating weir at Belleek to Knock island at low summer water; and another level from Knock island to Cumbor bridge on the Finn river, Belturbet on the Upper Erne, and Aghalane bridge on the Woodford river; the difference of level between the two reaches being concentrated at Knock island, the point I have chosen for effecting this.

In the eastern channel, between Knock island and Ring point, I propose to erect a system of balance gates on nearly the same principle as the Dutch balance gates, but more resembling those erected by Mr. Wicksteed, on the River Lea near London. The number of openings to be six of forty feet span each, and the height of the gates twelve feet; the openings to be separated by piers of ashlar masonry six feet thick, and the whole connected by a trussed timber bridge. It would be tedious to describe these gates in detail, and difficult to convey a proper idea of their construction and manner of working by a written description. I have therefore got a model of one opening, or pair of gates with the adjoining piers, made to a scale of half an inch to a foot, which I submit with this report for the Board's inspection.

In the western channel I propose that there be two openings, with gates of the same construction but of less dimensions, and a navigation lock of the usual construction 110 feet from recess to recess, and twenty feet wide between the uprights. The depth of water on the lock sills to be seven feet, under the summer level of the water in the upper and lower reaches respectively.

The slope necessary to discharge the flood-water in the river channel I have stated above as being assumed at three inches per mile, and to this slope the capacities of the cuttings through the shoals have been calculated. The distance of the proposed site of the balance gates from the Upper Lough, is nearly the same as the distance from the regulating weir at Belleek to the Lower Lough; therefore the length of river channel between the balance gates and the regulating weir, for which this slope must be provided, is still eleven miles. I assume that in dry summer weather the water's surface, after the proposed enlargement of the channels shall have been made, will approach so near a horizontal plane that the difference will be unappreciable, therefore the difference of level between the water's surface in the lower and upper reaches will be thirty-three inches, this will be the difference of surface level on each side of the balance gates, and the greatest lift of the navigation lock. The slope necessary to discharge the floods in the river channels, between the gates and the Upper Lough, will be obtained by an equivalent rise in the surface of the Upper Lough; and the range between the summer level and winter floods in each of the loughs will be from twelve to fifteen inches, as the lengths of river channel from the Upper Lough to the gates, and from the Lower Lough to the regulating weir are the same nearly. The rise of the floods on the upper sides of the gates will be gradual, indicating the proper time to open them in succession, and when they are all opened the flood-water will then have as much freedom to assume the calculated slope as if no gates existed.

The lift of the lock being small, the supply of water inexhaustible, with sluices of large opening, the time lost in passing will be so short as not materially to interrupt the traffic, and it can be approached from either the eastern or western channel by the connecting channels between them.

I propose that proper passages for the free migration of fish be made in each of the channels, although that generally takes place during floods, in which case a greater or lesser number of gates will necessarily be open.

Branch Navigations belonging to Lough Erne.

The Upper Erne river to Belturbet, and the Woodford river to Aghalane Bridge, require no additional works beyond those already described as sufficient for drainage and navigation combined, therefore they need no further particular notice.

The Finn River to Cumbor bridge.—Two memorials numerously signed were presented to the Board during the last year, having for their object the removal of the impediments to drainage and navigation at present existing in this reach of the Finn river; but it being under the dominion of the floods in Lough Erne, it could not be undertaken separately, and moreover it is situated naturally in this district.

A fall sufficient for the drainage could be obtained when the surface of Lough Erne is regulated, by excavating the shoals at an inclination of eighteen inches per mile; but the additional excavation for a navigable channel is not great, and will afford free access, without lockage or other interruption, to a populous agricultural country about nine miles in extent along this river, and the terminus at Cumbor bridge will be little more than a mile from the town of Clones. A small wharf will be necessary at Cumbor bridge for the accommodation of the trade.

The Creeve Navigation.—This navigation is by the Hollybrook river, Kilmore Lough, and Lough Head, to within a few hundred yards of Lisnaskea. The improvement of this navigation was undertaken by the Right Honorable the Earl of Erne at a considerable outlay, and a commodious wharf built near the town. It has been of much advantage to Lisnaskea, trade boats passing regularly between it and Wattle bridge, except in the dry season when there is a deficiency of water. The principal cause of the insufficient depth of water is the sand washed down by the Hollybrook and Colebrook rivers, in floods, having greatly choked up the channel. Although the course of the Hollybrook river has been diverted into Lough Head to prevent injury to the navigable channel, it has been attended with very little advantage.

When the diversion of the Hollybrook river, proposed above, is made, it will relieve the upper part of the Creeve from the sand washed down by floods, and entering Kilmore Lough at a distance from the line of navigation, there will be ample room for the sand to settle down without injury thereto. I propose also to effect a separation between the outlets of the two rivers into Lough Erne, by cutting a new channel at the point of Kilmore South, and embanking it against the Colebrook river with the excavated material I propose also to cleanse and deepen the navigation channel up to the wharf at Lisnaskea, so as to have five feet in depth at summer level.

The Kesh River.—The distance from Lough Erne to the town of Kesh is little more than a mile, and the levels show that a small additional excavation will make the river channel navigable up to the town, where I also propose to build a wharf.

Commodious wharfs will also be required at Enniskillen and Belleek.

Trade.

The opinions of the eminent engineers who have inquired into the capabilities of the Erne navigation for extensive improvement, and the advantages to the commercial interests of the country which its completion would confer, have been briefly stated above, together with the important results of the partial improvements already effected, but this report cannot well be closed without glancing at the present and prospective trade of the district.

The present project not being strictly one of commercial enterprise, nor to be undertaken by a joint stock company, solely with a view to the direct profits to be derived from the investment of their capital, a lengthened inquiry into the details of the trade would be rather foreign to the objects of this report; neither would it be a task easy of accomplishment, from the imperfect data available for that purpose Much of the trade being carried on by the ordinary conveyances of the country, satisfactory records of its amount do not in most cases exist, and scarcely in any case to be procured. I have been favoured with a statement of the number of tons conveyed by the Carrying Company of the Ulster Canal, to and from Lough Erne for two years, viz. :—

	Tons.
1846, . . .	8,706
1847, . . .	12,110

It is not intended that the incipient trade of this canal should be taken as a datum for estimating the trade of Lough Erne, but it is so far valuable, that it shows such a progressive increase as gives promise that when the navigation of the lough and navigations auxiliary thereto are completed it will in amount realize fully the anticipations of its warmest promoters; for it appears that the whole trade of the Ulster Canal in 1843 was but 13,391 tons, that part of it connected with Lough Erne in 1847 was 12,110, nearly equalling the whole trade of the former year. In Mr. M'Mahon's report on the navigation for the junction of the Erne and Shannon, now in progress, he estimates the minimum trade anticipated at 45,000 tons annually, and it will be conceded that he has not over estimated it, when the highly-important but hitherto much-neglected district through which it passes is taken into consideration. No estimate of the prospective trade of the Lough Oughter navigation, now also in progress, has been made, but it may be safely taken at half that of the junction canal, as it opens up the southern and western parts of Cavan, and contiguous parts of Leitrim. The trade of the county town of Cavan with the eastern seaboard is now considerable, but that part of it done by the Ulster canal does not enter Lough Erne, being landed at Wattle Bridge, and much of it is carried on by carts in the shortest direction across the country.

Enniskillen, the county town of Fermanagh, for situation as an inland trading town, is without parallel in the kingdom. It is the capital of central north-west Ireland, and if the project which is the subject of this report, be carried into execution as their importance demands, it would be excelled for general trade by few ports in the kingdom. It may therefore be interesting to see the market returns of this town for eight years, as furnished by the receiver of customs and tolls of the markets and fairs, as they show an encouraging gradual improvement in the sales of country produce, notwithstanding all the untoward circumstances which have pressed so heavily on the agricultural trade of the kingdom. The items in the following table have been copied from the market books:—

Description.	1839.	1840	1841.	1842.	1843.	1844.	1845	1846.	Remarks.
Horned Cattle and Horses,	3,544	3,230	3,614	3,721	3,694	3,570	4,126	4,242	
Sheep	2,314	2,263	2,428	2,496	2,531	2,753	3,481	3,397	
Swine,	3,848	4,321	4,414	4,086	5,201	5,861	6,965	7,446	
Casks of Butter,	20,618	24,311	24,201	24,460	24,771	24,802	25,897	25,998	70 lbs. each.
Sacks of Oats,	4,115	5,021	5,319	5,446	6,410	6,496	7,496	7,879	28 stone each.
Sacks of Wheat,	3,026	3,120	3,435	3,140	3,430	3,671	3,921	4,714	35 stone each.
Sacks of Potatoes,	9,764	10,431	10,651	10,216	10,470	10,465	10,426	10,157	30 stone each.
Sacks of Oatmeal,	890	985	928	941	980	969	998	987	28 stone each.
Stones of Flax,	480	497	461	414	435	419	480	539	

Mr. Robert Clegg, the receiver, states that since the opening of the Ulster Canal many of the merchants buy grain and butter at their own stores, and ship them off without their coming into the market, and much of the cattle change holders without paying toll. The principal part of the flax grown in the surrounding country is sent to Londonderry, and does not come into the Enniskillen Market.

The trade of this district may appear unimportant when compared with that of an equal extent of a country where manufactures have long been established, and extensive domestic and foreign commercial connections formed. Manufactures, generally speaking, there are none. The country is strictly agricultural and densely populated; therefore, when the present backward state of agricultural operations is kept in view, it is evident that if the necessities of the people are supplied, the surplus available for exportation is very limited. This has undoubtedly been made manifest by the late failures in the potato crop, when, in the absence of that staple article of food, the remaining produce of the country, in which there was no unusual deficiency, was found wholly inadequate; and to save the lives of the starving population, immense quantities of foreign agricultural produce were suddenly thrown into the country, proving that the surplus over the wants of the population of the only available branch of traffic in more fortunate years could only be comparatively small. One great cause of this is, no doubt, the generally-admitted fact, that under the present imperfect system of agriculture the land produces only one-half or one-third of what it might and ought to do, not to speak of the lands lying wholly waste.

It is, however, gratifying to behold an awakened spirit of enterprise and improvement in all parts of the district, in the efforts making to improve the land and introduce a superior system of agriculture; which, if persevered in, will soon increase the produce to such an extent as to leave a very large surplus over the wants of the population, to constitute a most valuable and remunerative export trade, the great capabilities of the land for extensive improvement being generally admitted. If then it is admitted that the imports must, in a great measure, depend upon the exports (for the latter must be in a ratio to the means of procuring them), therefore a deficiency in one causes a deficiency in the other, and acts prejudicially on trade. It is one of the principal features of this project, that it combines the drainage of the injured land with the opening up of the navigation, thereby forming the basis of the agricultural improvements in the district, and at the same time providing the cheapest and most facile means of transit for the marketable produce; entirely obviating the objection made, perhaps justly, to many of the public works in this kingdom, that they have been undertaken before there was an actual necessity for them, and are therefore unproductive as works of profitable investment. The relieving of so many acres of lands injured by flooding, and comparatively unproductive, would alone form no mean item in the increased produce of the country; and if to that be added the flooded lands of the adjacent districts, within the catchment basin of the Erne, the produce of from 50,000 to 60,000 acres of the richest land in the kingdom, would be available to swell the exports of the country; and the means of ready and cheap transit to market being afforded, the profits thereon will be proportionally increased, and many of the necessities and comforts of life, now unattainable, will be imported in return.

It is to be hoped, as it is most desirable, that the latent resources of the district will be speedily put in course of development, and thereby relieve the land from the excessive pressure of maintaining the whole population. It is a subject of deep regret, that large quantities of coal and iron should be imported into the district, when the coal-fields of Leitrim and Cavan extend almost to the shores of the lough, and ironstone of the best quality in such abundance, and in the most convenient situations. Sand-stone is also imported from Scotland, and even from the island of Portland, when inexhaustible supplies of the same description of material may be procured in Carumore and Sheve Rusheen mountains. When this navigation and those auxiliary to it shall be complete, affording complete access to these latent resources, and their ready transport throughout the country, such anomalies will no longer exist. The immense water-power of the district would also give facilities, almost without a parallel, to all kinds of manufactures; and when the junction canal is completed, Lough Erne will be connected with all the inland navigations in Ireland, placing it in the commanding position of affording the means of diffusing all over the kingdom the products of the surrounding country, and of sending them to the seaports for exportation.

In the above view of the case it is plain that the amount of existing trade in the district does not by any means form a criterion of the importance of this project; and its peculiar excellence is, that it is combined with, and proceeds simultaneously with, the improvements of the district. The peculiar natural facilities, also, will render its efficient maintenance comparatively trifling, and the tolls to be levied on the trade for that purpose alone, little more than nominal.

I am fully aware that it was not necessary to make these remarks to convince the parties most deeply interested in the project of its importance—to that they are fully alive; but in a report of this kind it could not well be passed over in silence.

ESTIMATE OF THE COST OF THE PROPOSED WORKS.

No. 1.—Estimate of the Cost of the Works of Drainage and Navigation combined.

	£	s.	d.
Excavation in rock, clay, gravel, and sand, in deepening shoals, enlarging channels, &c., from Belleek to Upper Lough,	46,239	9	5
Large and small tributaries and drains,	26,738	1	2
	72,977	10	7
Masonry in weir at Belleek lock, and balance-gates at Knock island, wharfs at Enniskillen, Belleek, and Kesh, and undersetting and enlarging bridges and culverts,	17,403	18	8
Valuation, plans, &c.,	1,800	0	0
Purchase of Dundas's eel weirs,	320	0	0
Reconstruction of Donaldson's weir at Belleek,	200	0	0
	92,701	9	3
Contingencies, &c., 10 per cent.,	9,270	2	11
	101,971	12	2
Probable sum required for interest on money borrowed,	6,884	14	6
	£108,856	6	8

No. 2.—Estimate of the Cost of the Works of Drainage alone.

Excavation in rock, clay, gravel, and sand, and purchase and reconstruction of weirs,	£66,280	11	3
Purchase of Dundas's eel weir,	320	0	0
Reconstruction of Donaldson's eel weir, at Belleek,	200	0	0
Valuation, plans, &c,	1,600	0	0
	68,400	11	3
Contingencies, &c., 10 per cent,	6,840	1	1½
	75,240	12	4½
Probable sum required for interest on money borrowed,	5,255	0	0
	£80.495	12	4½

No. 3.—Estimate of the Cost of the Works of Navigation alone.

Masonry in weir at Belleek lock, and balance-gates at Knock island, wharfs at Enniskillen, Belleek, and Kesh,	£13,171	17	8
Creeve branch,	1,266	13	4
Main channel, Woodford, and Upper Erne,	3,073	7	0
Plans, &c,	160	0	0
	£17,671	18	0
Contingencies, &c, 10 per cent,	1,767	3	9½
	19,439	1	9½
Probable sum required for interest on money borrowed,	1,312	9	0
	£20,751	10	9½
Chargeable to the navigation of the Finn river from Upper Lough Erne to Cumbor bridge, near Clones, should it be determined to carry it into execution; if not, this sum will be deducted from the amount of the general estimate,	2,356	19	0
Contingencies, &c., 10 per cent.,	235	13	10½
	£2,592	12	10½

No. 4.—Estimate of the Cost of the Works of Masonry chargeable under the Drainage Acts to the Counties.

	£	s	d.
Underpinning and enlarging bridges and culverts,	4,232	1	0
Plans, &c,	40	0	0
	4,272	1	0
Contingencies, &c., 10 per cent.,	427	4	1½
	4,699	5	1½
Probable sum required for interest on money borrowed,	317	5	6
	£5,016	10	7½

Summary.

Navigation,	£20,751	10	9½
Drainage,	80,495	12	4½
Counties,	5,016	10	7½
Finn Navigation,	2,592	12	10½
	£108,856	6	8

BENEFITS ANTICIPATED TO RESULT FROM THE GENERAL PROJECT.

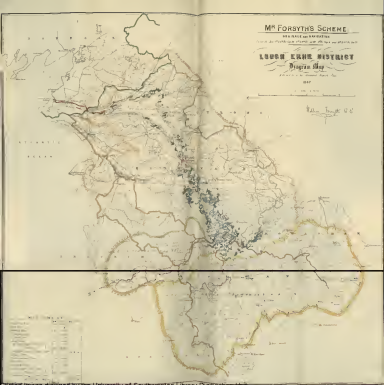
The execution of the proposed works would confer most important benefits on a large portion of the north-west of Ireland The advantages to be derived from relieving such a large territory of land (equal in intrinsic value to any in the kingdom) from injurious flooding, have been frequently referred to in the foregoing report, therefore, further comment does not appear to be necessary. It may however be stated, that the mere relieving of the lands from injurious flooding, is not by any means the entire benefit, great though it would be, which the execution of the proposed works would confer upon them. The regulation of the surface levels of the Upper and Lower Loughs Erne, and opening up of the drainage outfalls of the district, would form the basis of future improvements in thorough-drainage and agriculture, extending far beyond the bounds of the flooded lands, which are wholly impracticable in its present circumstances. But in making a prospective statement of the direct pecuniary profits, which would accrue to the proprietors of the lands from the sum expended in the execution of the proposed works, it must be limited to the increased annual value which would be given to the injured lands, by relieving them from injurious flooding and excess of moisture, arising from the present neglected state of the out-falls.

It appears from the valuator's schedule, that the quantity of flooded and injured lands in the district is 17,554 statute acres and 3 roods, which he values at £6,728 19*s.* 11*d.*, increased average present value per annum, the estimated cost of the works of drainage alone is £80,495 12*s* 4*d.*, therefore the return profit to the proprietors would be eight one-third per cent. per annum on the expenditure.

I am not prepared to state what the direct profits arising from the navigation would amount to beyond the cost of efficient maintenance. I have given all the statistical facts which I could collect, and stated my views of the subject under the head of Trade, in the foregoing report; but I conceive they are not sufficient to warrant me in making a specific statement of the amount of direct annual profit on the estimated cost of the works.

WILLIAM FORSYTH.

Belturbet, December, 1847.



MR FORSYTH'S SCHEME

DRAINAGE AND NAVIGATION

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LOUGH ERNE DISTRICT

Diagram Map

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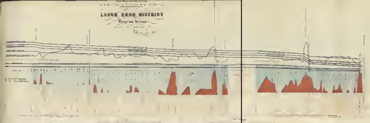
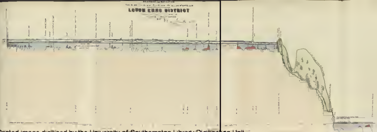
1847

William Forsyth C.E.


DRAINAGE AND NAVIGATION
LOUGH ERNE DISTRICT
Diagram Section


DRAINAGE AND NAVIGATION
LOUGH ERNE DISTRICT

APPENDIX No. 3.

Drainage Acts 26 and 27 Vic., Cap. 88, &c.

LOUGH ERNE DISTRICT, COUNTIES OF FERMANAGH, CAVAN, AND DONEGAL.

REPORT BY MR. S. U. ROBERTS ON MR. LYNAM'S FIRST SCHEME

Galway, 31st October, 1870.

SIR,—In compliance with the instructions which I received from you, dated the 14th June last, I have carefully inspected the proposed Lough Erne Drainage District, in the counties of Fermanagh, Cavan, and Donegal, and have held the necessary enquiry with the view of reporting for the information of the Commissioners on the project which has been submitted for the formation of the Lough Erne Drainage District under the provisions of the above Acts.

These proceedings have been taken upon the Petition presented by the Rev. J. G. Porter, and Mr. John G. V. Porter, who are proprietors of a large extent of the lowlands adjoining Lough Erne.

The plans for this drainage, and the schedules and estimates lodged with the petition, have been prepared by Mr. James Lynam, who in his report thus describes the district:—

"The low lands which it is proposed to improve by the flood drainage of the Erne lie on both sides of that river, and of the various loughs, and the low levels of the tributary streams for a distance of fifty miles from Belleek to Belturbet, and contain in the aggregate 15,691 acres. The important town of Enniskillen is in the centre of the district."

The importance of relieving these low lands from the flooding and injury to which they are at present subject and the great advantages which it is anticipated would result from opening the navigation of Lough Erne, have so long engaged public attention, that I presume the physical character of the district is familiar to all those who take an interest in its improvement, and a very brief description of it will suffice to enable the project now submitted for consideration being clearly understood.

Lough Erne, consisting of two Lakes, the Upper and Lower, which are connected by a long and winding river course, extends in a north-west and south-east direction, through the centre of the county of Fermanagh.

The upper lake, when at the ordinary summer level, has an area of 9,453 statute acres, but there are other minor lakes connected with it, the area of which is about 2,600 acres. It receives the surplus waters of a basin containing 846,880 statute acres, which is of very variable character as to its slopes and the rapidity with which the rainfall is discharged from its surface.

The shores of this lake are generally low, and the adjoining low lands to the extent of about 11,000 statute acres are subject to flooding both during the autumn and winter months.

The lower Lake has an area of 27,645 statute acres at its ordinary summer level. It receives the surplus waters from a catchment basin 209,280 statute acres in extent, in addition to the effluent waters from the upper Lake; its shores are generally high, and the lowlands adjoining it are of limited area.

The river course which connects these two lakes is eleven miles in length, and for a great portion of that distance is divided into two channels of very variable breadth and depth, and obstructed by shoals in several places.

The surplus waters of the Lower Lake are discharged by the River Erne, which issuing from its north-western point at Roscor, flows in a very insufficient channel to Belleek, where a shoal of limestone rock extends across the river course forming a great natural weir, over which the waters descend a height of thirteen feet in a broken and picturesque cascade, and passing under Belleek bridge in a channel of considerable depth, flow with a rapid inclination to Ballyshannon, the out-fall of the River Erne.

At the Belleek falls portion of the water is diverted to work the mills in connection with the extensive pottery works on the north side of the river, and on the other side a supply is taken for a small corn and saw mill.

The great natural obstruction at Belleek and the insufficiency of the channel from that to Roscor causes the flood waters to accumulate in the Lower Lake until its surface rises, after heavy rainfalls, to a height of 6·10 feet above its low summer level.

This increased height of the Lower Lake extends its influence into the Upper Lake, in addition to which the want of capacity in the channel connecting the lakes to discharge the vast quantity of water poured into the Upper Lake from its extensive rain basin, causes a rapid accumulation of the flood waters in it, until the surface rises, in extreme cases, to a height of 8·30 feet above its summer level.

The following Tabular Statement of the levels at Belleek, and on the Upper and Lower Lakes during different conditions of the water, have been taken from Mr. Lynam's sections, and have reference to his datum:—

—	Low Summer Water	Ordinary Winter Floods.	High Winter Floods.
Belleek Bridge (immediately below bridge).	7·97	10·80	Level not given.
On Crest of natural Weir at Belleek.	21·50	25·00	
Lower Lough Erne, . .	22·10	27·50	28·20
Upper Lough Erne, . .	22·55	29·10	30·85

From the above statement it will be observed that the surface inclination in the river between the Lower Lough and the crest of the weir at Belleek, a length of 3 miles and 196 perches, is 7·2 inches in low summer water, increasing to 2 feet 6 inches in ordinary floods, and that the inclination between the Upper and Lower Lakes, a distance of eleven miles, is 5·4 inches in low summer water, increasing to 1·6 feet in ordinary floods, and to 2·65 feet in high floods.

The project submitted by the Petitioners for the drainage of the district is as follows:—

To purchase the small mill on the south side of the river, and also the eel fishery at Belleek, and to cut two channels through the rock shoal at that place to a depth of 11 feet below the crest of the rock, each 100 feet wide, and formed with an inclination of 20 feet per mile.

At the head of each of these channels it is proposed to construct two "regulating weirs" placed at right angles to the line of current and constructed by moveable flood valves, so as to have the power of opening the whole of channel where necessary to carry the flood-waters.

"The summit of these valves is to be placed at the level of the hitherto low water in Lough Erne so that in a dry summer, when all the valves will be closed, there will be one uniform surface of water from the regulating weir at Belleek upwards to Belturbet, 50 miles.

"The fall in the surface will be then what will be necessary to propel the quantity of water flowing in summer, the fall of nine to twelve inches hitherto existing between the lower lake and Belleek eel weir wall will be lessened. The regulating weir will maintain the water at a height six to eight inches higher than hitherto, and thus prevent the loughs from falling below the level at which they have hitherto stood in dry summer weather.

"The level above the weir at Belleek can be easily regulated to prevent this.

"It is not intended to keep the great loughs down to the summer level in spring, nor in the months of May or June, during these months the water in the loughs will be kept low enough to leave the crops free from injury thereby, but not so low as to injure any interest. It is only at the season when destructive sudden floods may be anticipated that the loughs will be lowered to the minimum height. It has been said that the regulating of the waters of the Erne would diminish the value of the mill power now in use at Belleek or at Ballyshannon; there is no danger of this. The quantity of water flowing in that river in summer with the great falls available will give far more power than is now in use at Belleek and Ballyshannon, or is at all likely to be required in the present epoch."

It is proposed to form a channel varying from 300 to 500 feet in breadth and from $7\frac{1}{2}$ to 9 feet in depth from Belleek to the upper lough, the flood level of which it is anticipated will not rise above the level 22·50 feet above datum which is about the present ordinary summer level.

The volume of water which this channel is calculated to discharge when the lake attains its proposed maximum height, and when the flood valves at Belleek are open, is estimated at about 540,000 cubic feet per minute.

The river course connecting the upper and lower lakes is to be improved by excavating channels through the shoals at Portora, Enniskillen, and Killehevlin, at Black Rock straits and Arney in the west channel, and at Carry bridge on the east channel, and on the River Erne at Gubbe.

These channels vary considerably in width and from $7\frac{1}{2}$ to 9 feet in depth below the summer water line. By this means it is anticipated that a flood of 530,000 cubic feet per minute will be discharged without causing the upper lake to rise above the level of 24·95 over datum, which it is stated will be one foot below the general level of the low lands adjoining that lake.

The shoals at the mouth of the Colebrook and Arney rivers are to be removed with a view of relieving the low lands on the lower reaches of these rivers.

The cost of the proposed works is estimated at £69,289 7*s.* 5*d.*, the extent of land which it is anticipated will be improved is calculated at 15,650 statute acres, the present value of which is set forth at £7,862 7*s*, and the estimated increase in value at £6,060 18*s.* or nearly 7*s.* 8*d.* per statute acre.

Among the objections made at the meeting held in Enniskillen on the 24th of August last, there are only two to which I think it is necessary, specially, to refer. One was made by the Earl of Erne, who alleged that the project for the drainage of the district, as submitted by the petitioners would not be an effective or complete work.

The other was made by the owner and lessee of the Belleek Pottery Works, who were apprehensive that the proposed plan, so far as it affected the mill power would be most injurious and destructive to it.

I have carefully investigated these objections, and all others that were made during the inquiry, and have maturely considered all interests involved in the project.

During the inquiry I have received most active assistance from Mr. James Lynam, who has placed before me all the observations he had made, and the information he had obtained in the district. I have carefully considered the very able report made in 1847 by Mr. W. Forsyth, who appears to have closely and accurately investigated the physical features of the district, and placed upon record a most valuable report on its improvement.

With the advantage of all this information, I now beg to submit the following report for the information of the Commissioners, considering the project submitted for inquiry under the following heads:—

1. The sufficiency of the proposed works for the drainage of the district.
2. Their effect upon the navigation of the lake.
3. Their effect upon the mill power at Belleek.
4. The sufficiency of the estimate for the execution of the works proposed.

The first step to be taken in considering the sufficiency of the proposed works is to ascertain the maximum quantity of water, for the discharge of which, provision must be made, under a head that will secure the lands from injury.

The only information I have been able to obtain on this point is that contained in Mr. Forsyth's report of 1847, in which he shows that the maximum discharge from the Upper Lake for which it would be necessary to provide, was 700,000 cubic feet per minute.

This calculation is based upon a registered rise of ten inches surface of the upper lake in the twenty-four hours, which it is stated "had taken place but in two instances, only one in each season," and he expresses his opinion that "provision must be made for the discharge of that quantity at a head below the level of the low lands adjacent to the lough to secure them against inundation."

From the Lower Lake, Mr. Forsyth explains from the observations he made, that with a range of twelve inches in the surface of the lough available as a compensating reservoir, it would be sufficient to provide for a maximum discharge of 600,000 cubic feet per minute.

I find on examination of the registry of the level of the surface of the upper lake, which has been kept by Mr. Porter, at Belleisle, that no greater rise than that referred to by Mr. Forsyth is recorded in the same space of time, and consequently it may fairly be assumed as a maximum, although it might naturally have been expected that some increase would have taken place from the more rapid discharge of the flood waters resulting from the drainage of the Lough Oughter and Gowna, and River Erne district and also from the Ballinamore and Ballyconnell district, which improvements have taken place since Mr. Forsyth's observations were made.

I am of opinion that the discharge for which it is necessary to provide, at what I might term the two outfalls in this district, cannot be taken at less than that estimated by Mr. Forsyth.

The scale of the works provided by Mr. Lynam is not calculated for the dischage of so large a quantity of water, his plans have been designed with the view of relieving the lands from summer and autumn floods; he is of opinion that the great flood of August, 1861, which was an exceptional one, did not exceed 500,000 cubic feet per minute at Belleek, and states that for twenty years there has not been another summer or autumn flood so high as that of August, 1861. This calculation is based on the assumption that the proportion of the flood of August, 1861, to high winter floods in Lough Erne was the same as that of the same flood in the Shannon to its high winter flood, the latter of which were computed by very accurate measurements; but to render this comparison of use it would be necessary to consider the physical features of both catchments and to compare the extent to which the Shannon Lakes have been made available as compensating reservoirs with that provided by the plans under consideration for the drainage of Lough Erne district.

The arrangement proposed of ponding the lower lake up to its present ordinary summer level, and prevent its rising more than three or four inches by the action of the regulating valves at Belleek will have the effect of increasing considerably the volume of water to be discharged from the lower lake during floods.

The flood valves, which it is proposed to erect at the Belleek outfall, are designed on the principle of the Barrages in use on the Marne and Seine, and which, I understand, have been found to act on those rivers with much success.

I apprehend, however, that the velocity of the water at Belleek in floods which will approach 700 feet per minute, will be found to present a practical difficulty in working valves of this construction. The necessity of providing sluices or valves at Belleek capable of giving vent to the flood waters from the Lower Lake under a head that will secure a sufficient outfall from the Upper Lake is manifest, and the most suitable form is a matter of detail which it is not necessary at this stage of the proceedings to determine.

Whatever plan is ultimately adopted it is essential that the construction should be of a substantial and permanent character, commensurate with the importance of the intervals depending upon its stability.

Viewing the project submitted for consideration simply as a work designed for the relief of the low lands from inundation during *summer and autumn floods* and without reference to its effect upon other interests in the district, I am of opinion it would be found sufficient.

It is, I think, a matter requiring very careful consideration on the part of the proprietors whether a project contemplated to relieve the low lands from summer and autumn floods will meet the requirements of the district.

It must be borne in mind that the limits within which floods can be allowed to rise in the Upper Lough is very small, the rise of a few inches of water in the low lands will be nearly as destructive as a rise of some feet, and land occupiers may be induced by the security afforded from ordinary summer and autumn floods, into an expenditure on the improvement and cultivation of their lands which may lead to dissatisfaction hereafter.

EFFECT of the PROPOSED WORKS on the NAVIGATION of the LAKE.

The intention of the proposed works is, as before stated, to maintain the level of the Lower Lough at its present ordinary summer level of 22·00 feet over datum, and that this uniform level should extend into the Upper Lake subject to the incline due to the discharge of the water.

The present incline between the Upper and Lower Lakes at ordinary summer level is six inches. This is caused in a great measure by the numerous shoals in the channel, the removal of which will lower the Upper Lake some three or four inches. A very large extent of the Upper Lake is very shallow, and its navigation at present very imperfect.

The levels of the sills of the entrance locks to the Ulster and Ballinamore Navigation is 17·26 feet over datum, so that the depth of water on them will be thereby reduced to about five feet, and the depth in some of the shallows in the navigation course through the Upper Lake will be reduced to about the same extent.*

It appears that the Upper Lake now falls in dry summers to within three or four inches of the level, at which Mr. Lynam, by his plans, proposes to maintain it by the weir at Belleek, and he is of opinion that a depth of five feet would meet all the requirements of the navigation of the Upper Lake; he has made no provision in the plans and estimates for dredging these shallows or for lowering the sills and chambers of the entrance locks to the navigations referred to, or the maintenance on them of the depth for which they were designed.

The large advantage which might he obtained in diminishing the expense of the works at the outfall of the district by using the Lower Lake to as great an extent as possible, as a compensating reservoir, is lost in this design by the necessity which arises for keeping up the Lower Lake permanently to a high summer level, and yet does not prevent the depth of navigation in the upper waters being reduced to the extent I have stated.

I fully concur with Mr. Forsyth in the opinion he has so strongly expressed "that to maintain a uniform level at all times of the year from Crom Castle to Belleek, without either ruining the navigation in summer or submerging the low lands in winter, as wholly impracticable within a reasonable outlay."

EFFECT OF THE PROPOSED WORKS ON THE MILL POWER AT BELLEEK.

At Belleek the water power has, to a large extent, been applied to the working the machinery in connection with the pottery works, one of the most interesting manufactories in the country, and in connection with which a very large capital has been expended.

The maintenance of this mill power is, therefore, of considerable importance, and increases largely the difficulty of designing works for the efficient drainage of the district at a cost that will be remunerative.

By the project submitted for consideration it is proposed to maintain the level of the summer water forming the supply of this mill at the present ordinary summer level.

It is, however, proposed to increase the inclination in the surface of the water in the river between the lough and Belleek during floods, and thus render a channel of limited sectional area sufficient for the discharge of the effluent waters, that the level of the water at Belleek during floods should, by the opening of the valves, be run down from one to three feet below the summer level before referred to. The effect of this would be to deprive the mills in connection with the pottery works of a large portion of their present power during such periods, and would necessitate the execution of costly alterations in lowering the wheels and machinery.

Provision has been made for relieving the principal water-wheel from the back water to which it is at present subject during floods, and a sum of £500 has been provided in the estimate for "interference with the mill-power," which is thus referred to in the Report:—

"If on full inquiry it should appear that the small diminution of water power thus occurring for a short period in winter would cause pecuniary loss to the owners of the mill-power, it might be compensated in either of three ways, viz., by lowering the wheel, by erecting a new wheel, or by money payment, as may be found most suitable."

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* NOTE.—The level of the sills of these locks are not marked on Mr. Lynam's sections, and the heights I have given are the result of observations I made with him when examining the district in September.

It is, however, desirable that whatever alterations are determined on with reference to this mill-power, and the works in connection with it, should be set forth on the plans and sections, and sufficient provision made in the estimate for their execution, so that the owner and occupier may understand, and at the earliest stage of the proceedings, how their interests are likely to be affected.

SUFFICIENCY of the ESTIMATE for the EXECUTION of the PROPOSED WORKS.

I have checked the calculations of the quantities of the work which it is proposed to execute so far as the information furnished me admitted, and have carefully considered the prices at which the several works could now be executed, and am of opinion that including provision for the interest on borrowed money they would cost a sum of £89,596.

GENERAL OBSERVATIONS.

Objections were urged that the improvement of the several tributary rivers to Lough Erne, the lands adjoining, which are subject to flooding and injury, were not included in the district.

The cost per acre of draining lands in connection with a main outfall is generally very much in excess of the cost of draining those on the tributaries.

Strong objections have for this reason been urged in many cases by the proprietors of lands adjoining main outfalls to the drainage of lands on the tributaries unless included in the same district with those on the main outfall.

I cannot see from any information before me that any disadvantage would result to the proprietors of the injured lands on the tributaries to Lough Erne in consequence of their not being included in the district, except the delay which may take place in their forming other districts for effecting improvements.

I am, however, of opinion that the project under consideration would be more complete if the improvement of the tributaries within certain limits was included.

The Schedule, which has been lodged of the lands included in the district, has been compiled from the valuation prepared by Messrs. Brassington and Gale in 1847, and although it may be looked upon as a close approximation to the increase in value which may be anticipated from the drainage of this district, it requires for the purposes of this inquiry a complete revision, and thus an opportunity will be afforded of reconsidering those points which I have referred to in the design for the works, without causing any loss of time in taking the necessary steps for carrying them into effect.

The objections which have been made and the careful inquiry they have led to will naturally point out the revisions which are necessary, and which in my judgment will not be found materially to increase the cost of the works.

Though the project submitted for inquiry is confined to the drainage of the district, the improvement of the navigation in connection with it has been referred to as of very great importance, and indeed this is fully proved by the many efforts made to effect that object.

Enniskillen, the principal trading town in the north-west of Ireland, is favourably situated with reference to a most extensive system of inland navigation, and only requires the improvement of the Lough and River Erne to place it in immediate connection with Belfast, Newry, and other important towns by means of the Ulster Canal, with the Shannon by the Erne and Shannon Junction Canal, with Belturbet and the Midland Great Western Railway by the River Erne.

The extent of navigation which may be opened in connection with the execution of these drainage works at a comparatively small cost is very considerable, and fully justifies the zealous manner in which the project is advocated by those interested in the prosperity of Enniskillen.

To maintain the navigation of the upper lake at the required depth of six feet in that lake and at the entrances to the Ulster and Shannon Junction Canals necessitates the execution of costly works in designing any scheme for the drainage of the district, while in other respects the execution of the works necessary for drainage will materially improve navigation. I am of opinion, therefore, that in any revision of this project it will be desirable to separate the estimates for these branches of the work, shewing what increased cost is entailed by the necessity of maintaining the navigation, and what portion of the cost other sections of the work might fairly be chargeable to navigation in consideration of the improvement which will be effected, for I apprehend it will be found that it is only in conjunction with each other, these projects, which are calculated to benefit the district so largely, can be carried out with any reasonable hope of being remunerative.

I have thought it right to report thus fully on the project which has been submitted to me for inquiry in consequence of the large expense which has been incurred in the preliminary steps that have been taken, the large interests that are involved, and the great anxiety which there appears to be throughout the district to carry out the improvements.

I am, sir, your obedient servant,

SAMUEL U. ROBERTS,
Inspector.

The Secretary,
Office of Public Works,
Custom House, Dublin.

APPENDIX No. 4.

Drainage Acts 26 and 27 Vic., Cap. 88, &c.

LOUGH ERNE DISTRICT, COUNTIES OF FERMANAGH, CAVAN, AND DONEGAL.

INSPECTOR'S REPORT—MR. SAMUEL USSHER ROBERTS ON MR. LYNAM'S SECOND SCHEME.

Galway, 30th December, 1872.

SIR,—In pursuance of the instructions which I received from you hearing date the 1st May, 1872, I have carefully considered the project for the relief of the lowlands in the Lough Erne district from flooding, and for improving the navigation between Belleek and Belturbet, which has been submitted with the Memorial presented by Mr. J. G. V. Porter, and have held such inquiries as were necessary to enable me to hear fully the objections made to the plans and estimates and various details of the scheme, as well as the explanations and statements advanced in support of their sufficiency.

The design has heen prepared hy Mr. James Lynam, and the valuation of the lands included in the proposed district has been made hy Mr. John Brady of Cavan.

In October, 1870, I reported on a project for the drainage of this district which had previously heen submitted to me for similar investigation. The inquiry which then took place pointed to some revision in the plan proposed which appeared essential, and the project now under consideration has heen matured with all the experience and information ohtained from that inquiry, as well as from the previous investigation made hy other engineers.

The cost of the proposed works is estimated at £126,636, of which sum £21,328 is apportioned as chargeable to navigation, and £1,720 (being one half of the estimated cost of rebuilding or altering bridges on puhlic roads) to the counties in which they are situated, leaving the balance, amounting to £103,588 chargeable on the lands improved, the extent of which is calculated 17,437¾ statute acres, the present value of which is set forth at £10,328 3*s.* 10*d.*, and the estimated increase in value at £7,154 11*s.* 11*d.*, or nearly 8*s.* 3*d.* per statute acre.

I have carefully considered the objections which were made at the several courts held at Enniskillen, and have made such inquiry as I thought necessary to render clear to my mind some matters, with reference to which the evidence showed that a considerable difference of opinion existed among those engineers who were engaged in the investigation, and I now beg to submit the following report for the information of the Commissioners.

It will be observed that Mr. Lynam adheres in his revised plan to the general principle of the scheme submitted in 1870, that of regulating the waters of both lakes by means of sluices or sluice valves, placed at or near the outfall of the district, and thus maintaining "in dry summer weather, when all the flood valves will be closed, one uniform surface of water from the regulating weir at Belleek upwards to Belturbet."

The first step, in the consideration of the efficiency of the scheme he proposes, is to determine the quantity of water for the discharge of which provision must be made to secure the lands from flooding.

Mr. Forsyth, in his report on this district in 1847, calculated the maximum discharge, which it was necessary to provide for in the outfall from upper Lough Erne, to be 700,000 cubic feet per minute, that quantity being computed from measurement of the flood water detained in the lake during twenty-four hours after a heavy rainfall, in addition to the actual discharge during the same period, and he estimated the quantity entering the lower lake, for which he considered provision should he made, at 800,000 cubic feet per minute.

Mr. Barton, who appears also to have carefully investigated the physical features of the district, in his report of December 30th, 1870, to the committee of owners of flooded lands upon Lough Erne states, "I am led to conclude that 600,000 cubic feet per minute will he a safe flood discharge to calculate upon at Portora, with this contingency, that in some particular states of the lake, and coincidence of a second flood near Enniskillen with the time when the waters of the first flood were arriving there, there would he a discharge of prohahly 650,000 cubic feet per minute, and upon this conclusion I base my calculation of the channels required between upper and lower lake, deducting for the Sillies River above Enniskillen and the Arney where it comes in."

With reference to the discharge from the lower lake, he estimates "that 730,000 cubic feet per minute should he provided for, either hy channels from Rosscor to Belleek, or by allowing room for floods to he impounded for a time in the lower lake, and if all sudden floods can be impounded there, the channels would he sufficient if, as at Portora, they would convey away 600,000 cubic feet per minute."

Mr. Lynam does not state in his report what discharge he considers it necessary to provide for from the upper lake, but from his evidence at the inquiry, it appears that he does not calculate upon a larger quantity than 450,000 cubic feet per minute at Portora, and considers a channel sufficient to discharge 500,000 cubic feet per minute from the lower lake, when it is at a level of 21·00 over datum, will prevent its surface rising above the level of 22·10 in floods, at which height the channel he proposes will discharge 600,000 cubic feet per minute.

Mr. Barton stated he had measured the quantity of water passing through Portora on the 20th December, 1870, in a flood four feet over summer level, and found it to be 435,918 cubic feet per minute. The variation which took place in the level of upper lough Erne, while this quantity was being discharged is not however stated, but the observation is valuable as giving the actual discharge from the lake when it attained the height of 28·56 over datum, which was its level on that date.

I made observations on the discharge at Portora in different conditions of the river, the result of which is as follows :—

Date of Observation.	Height of Upper Lough Erne above datum, on annexed Section, at time observation was made.	Discharge in cubic feet per minute at Portora.
1872.	Feet.	Cubic Feet.
14th June, . .	25 86	190,000
6th December, .	28 94	410,435

NOTE.—The heights in the above table have reference to the datum line on Mr. Lynam's Section, which is 130 feet above the Ordnance datum.

All the lowlands adjoining Upper Lough Erne are covered with water when the lough attains the height of 26·86, and its area is then increased to about 24,000 statute acres.

From an examination of the register of the Belleisle gauge, which has been placed at my disposal, it appears that the Upper Lake generally rises to its maximum height, varying from 6 to 8 feet above its summer level, according to the wetness of the season, about the end of January; sometimes attaining that height as early as the end of December, and occasionally, not until the beginning of February.

These flood waters accumulate in quantities proportionate to the rainfall, the rate of accumulation varying in height from 1 to 10 inches in 24 hours, and a careful investigation of the register shows that the rate of about 4 inches in the 24 hours is of constant occurrence and is frequently maintained for several consecutive days, even after the lake has reached a height of from 4 to 6 feet above its summer level. The rise which took place in October, 1870, averaging $4\frac{1}{4}$ inches daily, continuing during 12 consecutive days, may be given as an instance, though, perhaps, exceptional as to its duration.

Rises in the surface of the lake exceeding 5 inches in 24 hours for any lengthened period are of less frequent occurrence, while those which much exceed that, are of short duration and are generally followed by a considerably diminished rate of accumulation.

The information afforded by this register and the discharges ascertained by my observations at Portora before referred to, form a reliable basis for computing the quantity of water to be provided for, and shows that to meet all ordinary cases of heavy rainfall provision should be made for the discharge of 650,000 cubic feet per minute from the Upper Lake at a level below that of the lands adjoining it.

The registered accumulations of water which have taken place in the lake after excessive rainfalls, such as those which have occasioned a rise of from 8 inches to 10 inches in the lake in 24 hours, are of exceptional occurrence, and would be attended with floods of such short duration, that it would not probably be considered prudent to incur the increased expense of executing works on a scale sufficient for their discharge at a level below that of the lands.

A comparison of the rain basin of this district with others of similar character, the discharges from which have been correctly ascertained, will give a fair approximation to the produce after heavy rainfalls, and from this comparison I am of opinion that the discharge from Upper Lough Erne may be safely estimated at ·80 cubic feet per minute per acre which gives a quantity of 637,840 cubic feet per minute.

The catchment basin of the Lower Lough, including that of the Sillies river, is 254,639 statute acres, and in consequence of the more rapid declivity of its slopes, a discharge during floods, of less than ·90 feet per acre per minute, cannot be safely calculated upon, this will give a quantity of 230,000 cubic feet per minute, making, in addition to the discharge from the Upper Lake, a total of 880,000 cubic feet per minute, entering the Lower Lake.

The Lower Lake section of the district differs considerably from the upper, both in the character of its catchment and the ratio between its area and that of the lake, and there are reasonable grounds for assuming that under ordinary circumstances, a large portion of its floods will have passed off before those from the Upper Lake have arrived in any considerable quantity, and that if provision is made for a quantity of 800,000 cubic feet per minute it will be found sufficient, the discharge of this quantity at the outfall being regulated by the extent to which the lake is made available for the detention of portion of the flood-waters.

Having thus computed the quantity of water to be discharged, it now remains to consider the sufficiency of the works designed for the relief of the lands in the district from flooding.

The channel proposed from the Lower Lake to Belleek will discharge 491,280 cubic feet per minute when the lake is at the level of 21·00 feet over datum, and 608,650 cubic feet when at 22·10 feet, but even with this discharge the produce of the catchment basin of the district as computed, will, in periods of continued wet weather, raise the surface of the lake in the space of six days to a height of 22·60 above datum, at which level the discharge at the outfall will have increasedto 667,650 cubic feet per minute.

This calculation assumes that it will be practicable, as Mr. Lynam proposes, to draw the lake down to the level of 21·00 feet over datum in anticipation of a rainfall, but making due allowance for the quantity of water entering the lake during the ordinary state of the river in the winter season, this will seldom be found practicable, and is not a safe condition to rely on.

If the Lower Lake attains a height of 22·60 over datum the inclination in the river channel between the Upper and Lower Lakes will be materially reduced, and the quantity which the catchment of the Upper Lake will produce, according to my computation, after heavy rainfalls of ordinary continuance, will not be discharged by the channels proposed at a level below that of the lowlands.

Mr. Lynam has attached considerable importance to the increased storage for portion of the flood-waters that will be provided in Lough Oughter on the completion of the works now about being carried out for the improvement of the lands in that district, and in the additional extent to which, by his plan, Upper Lough Erne will be rendered available for the same purpose, over and above the extent contemplated by Mr. Forsyth in his report of 1847. He is of opinion that these compensators will reduce the discharge from Upper Lough Erne, for which it is necessary to provide from 600,000 to 450,000 cubic feet per minute.

The works proposed in the Lough Oughter and River Erne district will not, however, have the effect of increasing, to any appreciable extent, the capacity of the lakes in that district for the detention of floods, the only change to be anticipated is that there will be a somewhat earlier discharge of the flood-waters, and the extent to which Upper Lough Erne can be made available as a compensator will be but narrow provision for the regulation of those floods which will frequently, for short periods, exceed the estimated quantity of 650,000 cubic feet per minute at its outfall.

Mr. Lynam has strongly advocated the principle that works calculated to relieve the lowlands in the district from summer and autumn floods will be sufficient, and states it to be the general opinion of the land owners of the district that winter floods do no injury. Regarding his project as one designed to effect that object, I am of opinion it would be found sufficient, but while fully admitting that security from Summer and Autumn floods would produce a large amount of benefit in this district, I apprehend that no scheme will give general satisfaction which is not calculated to relieve the lowlands at all seasons from floods, with the exception of those resulting from extraordinary rainfalls such as I have before mentioned.

That section of the works which provides for the maintenance of the mill power at Belleek is an important portion of the project. To effect this object Mr. Lynam proposes to form a canal on the north side of the river course from the site of the proposed sluices at Carrowkeel to Belleek, which will be available for the twofold purpose of carrying the quantity of water required for the Porcelain Factory Works, and for extending the navigation to Belleek, in a channel relieved from the high velocity of the water in the river during the floods.

This arrangement admits of an inclination being given to the river between Carrowkeel and Belleek altogether independent of the level required for the mill power at the latter place, and a reduction in the size of the channel between those points, proportionate to the increased rate of inclination thus obtained, but the expense of constructing the canal, which has been much under-estimated, more than counterbalances that advantage.

The proposed alteration in the level of the Lower Lake will reduce the water power of the Belleek Porcelain Works during some periods of the year, and "to compensate for this loss of power, and to obtain other facilities for the execution of the drainage works" it is proposed to erect an additional wheel of 50-horse power, and connect it with the machinery of the mill. This arrangement cannot be enforced under the provisions of the Act, and would probably be attended with an expense much in excess of the compensation which the owners of that property would be entitled to for the reduction of the water power.

With reference to the effect of the proposed works on the navigation, it will be observed that it is proposed to fix the summer level of the Upper Lake at the height of 22·30 above datum, which is $6\frac{3}{4}$ inches lower than its present ordinary summer level of 22·87, at which height there is 6 feet of water on the cills of the entrance locks of the Ulster and the Shannon Junction Canals. If the summer level be fixed at 22·30 it will in dry seasons fall lower, and there is this further contingency to be considered, that the arrangement proposed for regulating the lakes in anticipation of floods, involves the necessity of draining the Lower Lake down below its proposed ordinary level of 22·10, and any error of judgment on the part of the officer in charge of the sluices at Carrowkeel, in anticipating rainfalls, would have the effect of reducing the Upper Lake below its proposed summer level.

The chart of the Upper Lake shows that a very large extent of it is shallow, and though the necessary depth may be obtained in the main lines of navigation by dredging the shoals and lowering the cills of the loughs referred to, the existing navigation of the lakes, which is so extensively used throughout its entire extent in connection with the agricultural operations of the lands adjacent, would be seriously injured.

The form of sluice valves proposed at Carrowkeel, according to the design submitted, is not one which in my judgment would be found to work satisfactorily. I fully approve, however, of the general principles upon which Mr. Lynam states in his report these valves should be constructed, and it is not now necessary to determine the form best suited for them.

The estimate provides for the improvement of the tributary rivers so far as the influence of the floods in the lakes extend; but it will also be necessary to open up the principal main drains and minor streams, so as to give those lands, which are remote from the river or lakes, the same advantages in outfall for drainage as those adjoining them will derive from the lowered level of the water.

I have carefully considered the estimate which has been prepared for this project, and have checked the quantities of work to be executed so far as the plans and sections submitted and other information furnished to me during the inquiry admitted, and am of opinion that the works proposed by Mr. Lynam, including interest on the money borrowed for their execution, will cost a sum of £165,382.

As the project embraces, in connection with the drainage of the flooded lands, the improvement of that portion of the navigation between Belleek and Belturbet and the branches leading to the Ulster and the Shannon Junction Canals, a portion of the cost of the proposed works is set down as chargeable to navigation, and Mr. Lynam states in his report that a large sum has already been voted by the Legislature for this purpose.

Until the works to be executed are determined upon, the cost of those required for the special purposes of navigation cannot be ascertained; and as a portion of their cost would probably be placed on the counties or districts benefited, I presume a special Act will be necessary to regulate the charges.

The valuation of the lands included in the district has been, to a considerable extent, based upon that made by Mr. Brassington in 1848. The increase in value is calculated at £7,154 11*s.* 11*d.*, which may in my judgment be looked upon as a very moderate estimate of the improvement that would result from the efficient relief of the lands from flooding.

The interests involved in this district,—the desire shown by all parties to secure an efficient and comprehensive scheme for its improvement,—and the large expense which has been incurred in the promotion of the project now under consideration,—have increased my anxiety to give the plans submitted for inquiry the most careful consideration. Fortunately there is now on record a series of observations which furnishes means of determining the basis on which works for the improvement of the district must be designed to secure a successful result, and their application to the plan under consideration shows, as I have before explained, that in many essential points it requires revision, and I much regret that under the circumstances I am unable to recommend the scheme submitted to the favourable consideration of the Commissioners.

I am, sir,

Your obedient servant,

(Signed), SAMUEL U. ROBERTS, M.I.C.E.

APPENDIX No. 5.

Drainage Acts, 26 and 27 Vic., Cap. 88, &c.

LOUGH ERNE DISTRICT, COUNTIES OF FERMANAGH, CAVAN, AND DONEGAL.

REPORT BY MR. S. U. ROBERTS ON MR. LYNAM'S THIRD SCHEME.

8, Great Denmark-street, Dublin,
27th February, 1874.

SIR,—Referring to my report of the 30th December, 1872, on the project for the relief from flooding of the low lands in the Lough Erne district submitted to me for inquiry, and to your communications of the 14th and 23rd of June last on that subject, I beg now to inform you that having very fully explained to Mr. Lynam, the Engineer to the promoters of the project, the alterations which appeared to me necessary in the plan to render it effective for the relief of the lands, and one which would, at the same time, preserve the public interests in the navigation of the lake and the lands in connection with it, he has in accordance with those views revised the plans and estimate, and has supplied much additional information that was required for the consideration of the project.

The general features of the district, the nature and extent of the injury to which it is subject from flooding and insufficient drainage, the quantity of water for which it was, according to my computation, necessary that an efficient discharge should be provided, at a level that would relieve the low lands from flooding, were so fully entered into in my last report that it is unnecessary I should again refer to them.

In the revised project now submitted, it is proposed to fix the low summer level of the lower lake at the height of 150·5 feet over Ordnance datum, which is about 1½ feet lower than the ordinary summer level has been heretofore, and the winter or maximum height at 152·00 feet. To effect this the channel from the lake to the outfall at Belleek is designed of sufficient capacity to discharge 410,000 cubic feet per minute when the lake is at the lower or summer level, and 600,000 cubic feet per minute when at the winter level.

The reductions in the height of the water in this lake renders it necessary to make alterations in the mill-power, fisheries, and other works at Belleek, the details of which I will refer to hereafter.

The channel connecting the upper and lower lake is to be improved to such extent as it is calculated will limit the maximum height of the upper lake, except in the case of extraordinary rainfalls, to 155·50 over datum, which it is stated will be sufficiently low to secure all lands in the district from flooding, with the exception of some low margins of inconsiderable extent.

The reductions in the level of the lower lake and the improvement of the channel between it and the upper lake would, however, have the effect of running down the upper lake in summer to a level that would very injuriously affect the public interests in its navigation, and to guard against this it is proposed to construct a weir, consisting of a series of sluices, across both the east and west channels of the river at Knockisland, providing in the western channel a lough of dimensions suitable for the navigation.

By these means the summer level of the upper lake will be maintained at the level of 153·00 feet over datum, which is its present ordinary summer level and at which height there will be a depth of 6 feet on the lower cill of the entrance lough to the Ulster Canal.

The boundary of the district to be improved is, I think, very properly defined as nearly as possible by the limits of the direct influence of the floods in the loughs, and the improvement of the several tributary rivers, minor streams, and main drains, so far as these floods extend, has been provided in the estimate with a view of extending to those lands, which are remote from the lake, the full advantage that the lowered level of the lakes will render available for their improvement.

Such are the general features of the project in the revised form in which it is now submitted, and the cost of the proposed works is £167,782.

Since my report was made in December, 1872, contour surveys have been made of the extent of land in that portion of the district above Enniskillen subject to inundation at different levels of the lake, the result of which shows that at the height fixed for the proposed winter level of 155·50 feet, no land, except some margins of about 200 acres in extent is flooded, and that when the water rises to 156·00 feet only 586 acres are subject to inundation, and as the water rises above that height, the low lands become gradually submerged—the whole district being under flood when the lake attains the height of 158·36 feet over datum.

These observations have been made with the view of determining with accuracy the quantity of water that in certain periods accumulates above Enniskillen after heavy rainfalls, and the calculations based upon them and the measured discharge of the effluent waters show that to secure the low lands from flooding, the river channel between the upper and lower lakes must be improved, so as to render it capable of discharging under a head that will not in the upper lake exceed the height of 155·50 over datum, a quantity of water which at Portora will amount to 600,000 cubic feet per minute.

This quantity is somewhat less than that estimated in my former report, and as it is based upon the more accurate observations which have since been made, it may, in my opinion, be relied upon as a close approximation to the flood discharge for which it is necessary to provide.

The periods and duration of the great accumulations of water in the upper part of the district have been carefully registered, and show that, owing to its physical character and the large area of the lakes within its limits, the influx of water into Lough Erne does not attain its maximum quantity until the action of those lakes as compensating reservoirs for the detention of floods is exhausted, and the result is that, except in extraordinary instances, the influx does not exceed 500,000 cubic feet per minute during that part of the year between the middle of the months of March and October. and that influxes exceeding that quantity have been, with few exceptions, confined to the months of January and February, and seldom last longer than four or five consecutive days.

On the same basis of calculation as that described in my last report, I compute the produce of the catchment basin of the lower lake at 230,000 cubic feet per minute, making, in addition to the discharge from the upper lake, a total of 830,000 cubic feet per minute entering the lower lough after heavy rainfalls.

Under ordinary circumstances there is no doubt but that in consequence of the precipitate nature of the catchment basin of the Lower Lake, a considerable portion of its flood-waters will have passed off before those from the upper lough reach it in any considerable quantity, but however favourable this may be in ordinary cases, there is the possibility of the discharge of a second flood from the catchment of the lower lough arriving concurrently with the maximum discharge from the upper, and I do not consider it would be safe to provide for the discharge of less than 750,000 cubic feet per minute at the outfall, the discharge of that quantity being regulated by the extent to which the lower lake may be made available, and safely calculated upon as a reservoir from the detention of portions of these floods.

The works which, according to the revised plans, have been designed for the discharge of these quantities of water within the limits necessary to relieve the district from flooding, except in cases of extraordinary rainfalls, for which it does not appear prudent or desirable to provide, are as follows :—

To excavate channels 120 feet in width through the two rock shoals below Belleek Bridge, so as to secure the discharge of floods at a level that will relieve the water wheel at the porcelain factory from backwater.

To purchase and remove the eel weir at the Belleek Falls, and excavate channel through the rock shoal at that place, commencing with a width of 70 feet immediately above Belleek Bridge, and increasing gradually to a breadth of 300 feet at the head of White Island, the bottom above Belleek Bridge being excavated to a depth of 134·00 feet over datum, rising to a height of 139·00 feet at the head of White Island, and thus having a fall of five feet in this length of 1,300 feet.

A channel 300 feet in width is to be excavated through the shoals at Graffy Sally Island and Carrow Keel, near the upper end of which it is proposed to place the weir or sluices, by means of which the waters of the lake are to be regulated. The bottom of the channel at the end of Graffy shoal is to be 140·20 feet, and that at the upper end of Carrow Keel shoal 143·44 feet over datum.

This arrangement necessitates the construction of a canal on the north side of the river for the two-fold purpose of maintaining the water-power of the Belleek factory works, and to extend the navigation to that place which is considered of importance. The proposed canal is to be twenty feet in width at the bottom and five feet in depth at the low summer level of the water. These dimensions have been determined by the provision necessary for the maintenance of the water power of the Belleek factory.

The altered level of the waters of the lake will reduce the working water power of the Belleek factory about four feet, and although the removal of the back water, to which it is at present subject in floods, will to some extent compensate for this reduction of the head, it has been thought desirable to provide for the erection of a new wheel and connect it with the machinery of the mill, leaving the old wheel unaltered as to level, but to lower the head race and sluice so as to admit of the application to it of the reduced power. This arrangement is made with a view of compensating for the reduction of the present power and to afford facilities for the execution of those works in connection with it.

The principal object of placing the regulating weir or sluices at Carrow Keel is to obtain an increased rate of inclination in the channel between that point and the falls at Belleek without causing a corresponding diminution of the mill-power, and by means of the canal to relieve the navigation from the effects of the high velocity which must necessarily be maintained in the river channel throughout a great portion of the year, it is also considered that the arrangement will afford facilities for the execution of the works without any lengthened interference with the mill-power at Belleek, during their progress and though attended with greater expense than the plan originally proposed of placing the sluices at Belleek, it is considered that the advantages referred to are such as to justify the increased outlay being incurred.

The detail drawings for the sluices have not been furnished, but the general plan shows that it is proposed to erect a series of thirty-two ordinary lifting sluices, each ten feet wide, worked by manual labour, in cast iron piers of narrow widths, the cills being placed at the level of 143·10 feet over datum.

The channel through Rosscorr is to be 400 feet in width, and excavated to a depth of 143·00 feet over datum at the lower, and 144·00 feet at the upper end.

The lower lake to the extent of 1½ feet in height on its surface, or within the limits of 150 feet and 152 feet over datum, is to be made available as a reservoir for the detention of portion of the floods, and this is taken advantage of, to reduce the size of the channel between it and the outfall at Belleek.

A channel is to be excavated through Portora shoal having a width of 250 feet at the upper, and 220 feet at the lower end, narrowing to 200 feet in the centre, the bottom being 141·25 feet over datum.

On the west channel in Enniskillen it is proposed to maintain the present bridge the aggregate breadth of water way of which is 136 feet, and to underpin the piers and abutments.

The new channel is to be 190 feet wide at the upper end, and diminishing to 158 feet at the lower end, the bottom varying from 141 to 142 feet over datum.

On the eastern channel it is proposed to excavate a river course 100 feet in width to the level of 144·00 over datum, and to underpin the piers and abutments of the bridge.

At Holy Island the channel is to be excavated for a width of 300 feet, to the depth of 141 feet over datum.

At Killyhevlin the breadth of the cutting will average 250 feet, the bottom being 141 feet over datum at the lower, and 141·50 feet at the upper end.

Between Killyhevlin and Knock Island it is proposed to cut a channel through the shoals in the East Channel, at Cleeuish Island, 200 feet wide, and the bottom 144 feet over datum.

On the west channel at the Blackrocks the channel is to be excavated to a breadth of ninety feet, and to a depth of 146 feet over datum, and at this point the weir and sluices, before referred to, are to be constructed, and on east channel the site selected for the proposed sluices is at Ring, where a channel 310 feet in width is to be made to the depth of 144 feet over datum.

Following the western channel of the river, cuttings are to be made through the shoals at Drumcoole and Drumcramph 200 feet wide, and sunk to a depth of 146 feet over datum, and through that at the mouth of the Arney River the channel is to be of an average width of 240 feet, and sunk to 146 feet over datum, and through a shoal at the debouch from the lake a channel 200 feet wide is to be sunk to the same depth.

On the eastern channel above Knock Island cuttings are to be made through the shoals at Curragheens, 200 feet wide, at Carry Bridge, 132 feet wide, and at Belleisle, 300 feet in width, all sunk to the depth of 146 feet over datum, and the pier and abutments of Carry Bridge are to be underpinned.

The detailed drawings of the sluices and weir proposed at Knock Island have not been furnished, but it is stated that the arrangement is to be similar to that at Carrow Keel, and that the lock is to be 130 feet in length and twenty-five feet in breadth.

The upper lake to the extent of 2½ feet in height on its surface or within the limits of 153·00 feet, and 155·50 feet over datum, is to be, in a similar manner to the lower lake, made use of as a reservoir to equalize, so far as its limited extent will permit, the discharge of the flood waters from its debouch.

On the Upper Erne, channels are to be excavated through the shoals at Grubbe Quiry Lough and Blenane so as to extend the navigation up to Pink Grove, near Belturbet. These channels vary from 120 to 130 feet in breadth and are to be sunk to the depth of 146 feet over datum.

The Finn River is to be improved up to Cumbor Bridge, a length of nearly 9 miles, channels being formed through the various shoals, 50 feet wide at bottom, sunk to the level of 147 feet over datum at Wattle Bridge and rising to 149·5 feet at Annie's Bridge, and the bridges at Wattle, Gertnacarrow, Annaghmullen, Ballyhoe, and Auriels are to be underpinned.

On the Woodford River the shoals at the mouth of the river and also that at Killynick are to be removed so as to extend a 6-foot navigation up to Aghalane Bridge.

The shoal at the mouth of the Colebrook River is to be excavated from the deep water in Lough Erne into Kilmore Lough; and the shoals at the outfalls of the Swanlinbar and Arney Rivers are also to be removed.

The Moor Lough River is to be improved throughout its entire course from the lake up to the railway bridge, and the Kay River from its junction with the Woodford River up to Drumrus corn mill.

All the minor tributaries and main drains throughout the district are to be opened up and improved so as to extend to all lands within it the full benefit which will result from the lowered level of the waters.

The cost of the works I have thus described is calculated at £167,782, the details of which are set forth in the estimate furnished.

The design for the works in connection with the mill-power at Belleek requires some modification, more particularly as I am of opinion that the erection of the proposed new wheel and other works in immediate connection with it have been underestimated.

The execution of the works at and near Belleek will necessarily involve more or less interference with the water-power of this mill, for the satisfactory working of which during their progress careful provision must be made, and the safest course in my opinion will be to erect a suitable steam engine to work the machinery of the factory during the execution of those works, and provide compensation for the reduction in the power consequent upon the lowering the level of the head water.

I am apprehensive that lowering the wheel with the view of maintaining the power of the mill at the altered levels would probably be attended with liability which it is desirable to avoid as far as possible, though every effort should be made to meet the views and reasonable requirements of the owners of a factory which is so satisfactorily developing one of the industrial resources of the country.

I have altered the estimate in accordance with this view, and should it be thought desirable hereafter to adopt the alternative plan of lowering the wheel the money provided will be found sufficient for the purpose.

According to the detailed information which has now been furnished, the cost of the canal on the north side of the river, which the position selected for the sluices at Carrowkeel renders it necessary to construct, though much in excess of the estimate previously submitted, is less than I anticipated, and removes to a considerable extent the objection made to it on these grounds. In considering the merits of this portion of the project it is essential to bear in mind, the necessity of keeping down the lower lake, where practicable, to its low level during the winter season, so as to obtain the maximum amount of fall between the upper and lower lakes during the early periods of high floods, and also to secure the full benefit of the one and a-half feet in depth on its surface being available when required as a portion of the flood waters entering it. This will render it necessary to provide for the discharge of about 410,000 cubic feet per minute at the outfall when the lake is at the low level, which can be effected with less injury to the mill-power by the arrangement proposed than the plan originally contemplated of placing the sluices at Belleek, and though attended with larger cost it is a safe if not the most judicious arrangement to adopt.

The details of the sluices at Carrowkeel, and of those at Knock Island will require much careful consideration. I have assumed that they will be of sufficient capacity to discharge floods without loss of head, and so constructed as to admit of the water being impounded at the high level in both lakes on the approach of the dry season of each year, so as to maintain under suitable regulations a reserved supply for the mills and fisheries on the river during the summer season, and preserve the required depth of water for the navigation.

The height at which it is proposed to maintain the low level of the upper lake removes all apprehension as to its navigation or that of the canals in connection with it being injuriously affected by the proposed works. The lower lake is throughout the greater portion of its extent of very considerable depth, and though the proposed reduction in its level will not be detrimental to its principal lines of navigation, the alteration will, no doubt, be attended with inconvenience to many of those resident on its shores, who have local interests in the maintenance of the present level. These objections may however be removed by extending the existing landing places and dredging shallow channels through shoals for which purpose the addition I have made to the estimate under the head of contingencies includes ample provision.

I have checked the quantities of work to be executed according to the revised plans, and have carefully considered the prices at which it is reasonable to expect the work can now be performed. I have made some alterations which have reduced the amount to £165,289 11*s.* 6*d.*

The cost of the works necessary for the relief of the lands in this district from flooding is largely increased by the necessity of maintaining unimpaired the existing navigations, in addition to which special works have been provided for their improvement and extension which will be attended with large advantages to the surrounding country.

The increase in the value of the lands included in the district, the extent of which is set forth at 17,437¾ statute acres is estimated at £7,154 11*s.* 11*d.*, which appears a very moderate calculation of the improvement which is likely to result from the execution of the proposed works.

The project in its revised form will, in my judgment, be found effective for the relief of the low lands in the district from flooding except in those cases of extraordinary rainfalls which, though not of frequent occurrence, cause excessive floods of short duration, for the discharge of which at a level below that of the lands it does not appear prudent or desirable to provide, and though the design in many of its details will still require much careful consideration it is one which, subject to these observations, is in my opinion entitled to favourable consideration.

I am, sir,
Your obedient servant,
(Signed), SAMUEL U. ROBERTS,
Inspector.

The Secretary,
Office of Public Works, Dublin.

APPENDIX No. 6.

Drainage Acts, 26 and 27 Vic., Cap. 88, &c.

LOUGH ERNE DISTRICT, COUNTIES OF FERMANAGH, CAVAN, MONAGHAN, AND DONEGAL.

REPORT BY MR. S. U. ROBERTS ON MR. BARTON'S SCHEME.

8, Great Denmark-street,
Dublin, 15th June, 1874.

SIR,—In compliance with the instructions conveyed to me in your letter of the 13th of January last, I have held the necessary inquiry, as Inspector, with reference to the petitions presented by Lord Erne and other proprietors, proposing that a drainage district may be constituted comprising all the lands within certain limits adjoining Lough Erne, and called the "Lough Erne Drainage District." The plans setting forth the various works, by which it is proposed to effect the improvement of this district, have been prepared by Mr. James Barton, and the valuation of the lands included in it has been made by the Messrs. Brassington and Gale.

The project now submitted by the petitioners for the drainage and improvement of the district is as follows:—

To purchase and remove the small mill on the south side of the river at Belleek, and to cut a channel, through the rock shoal at that place, varying from 140 to 200 feet in width, and to a depth of 13½ feet below the crest of the rocks.

In this cutting at the upper end of Belleek Island, and between it and White Island, it is proposed to construct eight sluices, each having a clear opening of 20 feet, with the cills fixed at the level of 27·80 feet above datum. They are to be constructed on the ordinary principle of lifting sluices, and worked by suitable machinery driven by water-power. It is by means of these sluices that it is proposed to maintain and regulate the level of Lower Lough Erne, and they therefore form an important feature in the design.

The head and tale races and the water-wheels of the Belleek pottery works are to be lowered 4½ feet, and to admit of the proposed works being carried out without injurious interference with the factory, it is contemplated to provide temporary power to work the machinery during their progress.

The eel weir at the Belleek Falls, is to be reconstructed in the new channel in as nearly as possible its present position, and the old bridge is to be removed, the road diverted and straightened, and a new bridge with one span of 100 feet erected.

Between Belleek and the lower lake a channel is to be cut through the shoals at Graffy, Carrakeel, and Rosscor, having an average bottom width of 200 feet, and a depth of 11·3 feet below the proposed flood line.

It is anticipated that these works under proper supervision will have the effect of regulating the surface of Lower Lough Erne, so that the summer or low level will not fall below 49·50 feet, or the winter or maximum level rise above 52 feet over datum, thus giving a range or depth of 2½ feet for the accumulation or detention of portion of the flood waters.

The river course connecting the upper and lower lake is to be improved by excavating channels through the various shoals; that at Portora is to be 170 feet wide at bottom, and 11·5 feet below the proposed flood line. The east bridge at Enniskillen is to be under-pinned and the shoals in the eastern channel deepened. The west bridge is to be replaced by either a suspension bridge in one span of 160 feet, or one span of 86 feet, and two of 40 feet each, and the shoal on which the present bridge stands is to be excavated to a depth of 11·5 feet below flood line.

At Castleisland, Rossory, Killyhevlin, Lisgoole, Cleenish, Blackrocks, Knockisland, Drumcramph, Whilliter, Arney, Inishmore, Carry Bridge, and Belleisle, cuttings are to be made through the shoals, varying in width and depth proportionate to the flood waters to be discharged.

On the west channel at Knockisland it is proposed to construct on the Blackrock side, a lock 150 feet long and 25 feet wide, and to place in connection with it, and across the river channel, a system of four sluices similar to those proposed at Belleek; and upon the eastern channel, in the wide open above Ring, to construct across it another group of nine sluices of the same dimensions, so as to maintain the waters of the upper lake during the dry seasons at the level of 52·50 feet over datum, at which height it is stated there is 6 feet of water on the cill of the lock at Wattle Bridge.

The summer or low level of the lower lake is to be, as before stated, fixed at 49·50 feet over datum, and assuming that the inclination in the 8 miles of river between the lower lake and Knockisland, will, in low water, he about 2 inches, the fall at the lock at Knockisland will he 3 feet.

On the *Upper Erne* it is proposed to lower the shoals between Innisfendra and Gubb to 6 feet below the summer level, and to cut channels, chiefly with the view of improving the navigation, through the shoals at Quiry Lough, Foalies, Blocksom'sford, Pink-grove, and Belturbet.

On the *Woodford River*, the shoals at Carraback and Killynick are to be deepened, so as to extend a 6-feet navigation up to Aghalane Bridge.

The *Finn River* is to be improved up to the weir below Cumbor Bridge, and also its two tributaries, one of which passes under the Ulster Canal, and the other by Crockerahoas Bridge.

The *Moor Lough River*, as far as Screevagh Bridge, and a small tributary east of it are also to be relieved.

The *Swanlinbar River*, as far as the Belturbet and Enniskillen Road, and a small tributary lying to the south of the town of Swanlinbar are to be opened up.

The improvement of the *Rag River* up to Killywilly Lough, the *Colebrook River* up to Ballindarragh Bridge, the *Creeve River* up to Lough Head, the *Hollybrook River*, from Kilmore Lough to *Carrickmacosker*, the *Arney River* up to Upper Lough Macnean, the *Sillies River* as far as Glencurry Wood, and the removal of the shoals at the mouth of the *Kesh* and *Bannagh Rivers*, are also included in the project.

In addition to the foregoing, the improvement of 98⅔ miles of minor streams and leading main drains are provided for, with a view of extending to all lands included in the district, the full advantage to be derived from the lowered level of the flood waters in the lake and main rivers.

The size of the channels between the Upper and Lower Lakes are calculated for the discharge of a flood, assumed to be 600,000 cubic feet per minute, at Portora, after the Lower Lake has risen to its maximum height of 52·00 feet, and all its space for impounding floods had been exhausted, and the channel between it and Belleek is calculated to discharge 350,000 cubic feet per minute, when the lake is at the low level of 49·50 feet, increasing to 600,000 cubic feet when it rises to its maximum height of 52 feet over datum, giving an average discharge of 475,000 cubic feet per minute.

The cost of the proposed works is estimated at £167,755 14*s.* 10*d.*, of which sum £31,946 19*s.* 1*d.*, is apportioned as chargeable to navigation, and £4,666 12*s.* 4*d.*, (being part of the estimated cost of rebuilding or altering bridges or public roads), to the counties in which they are situated, leaving the balance, amounting to £131,142 3*s.* 5*d.*, chargeable on the lands improved, the extent of which is calculated at 20,633¼ statute acres, the present annual value of which is set forth at £12,493 16*s.* 10*d.*, and the estimated increase in value at £7,832 13*s.* 11*d.*, averaging 7*s.* 7*d* per statute acre.

The design for the improvement of this district has been prepared with the view of providing for the relief of the low lands from flooding, and at the same time, preserving the public interests in the existing navigation of the lake, and the canals in connection with it, in a state of improved efficiency. The scale upon which the works have been designed is based upon observations of flood discharges and registers of the concurrent variations in the surface levels of the lakes, considered with due regard to the physical features of the district, so far as they are likely to affect the discharge and duration of floods

These observations are fully set forth in Mr. Barton's report, and he states, "lead him to conclude that 600,000 cubic feet per minute will be a safe flood discharge to calculate upon at Portora, with this contingency, that in some particular states of the lake and coincidence of a second flood near Enniskillen with the time when the waters of the first flood were arriving there, there would be a discharge of probably 650,000 cubic feet per minute, and upon this conclusion I base my calculation of the channels required between Upper and Lower Lake, deducting for the Sillies River above Enniskillen, and the Arney where it comes in."

The influx of water into the Lower Lake, Mr. Barton assumes, will for some days amount to 800,000 cubic feet per minute, and he states "that under these circumstances the quantity of water which will be impounded, 300,000 cubic feet per minute, if running continuously, would take seven days to raise the Lower Lake 2½ feet, the reservoir is therefore I think sufficient to insure in all ordinary years, that the quantity of flood will (when the lake has risen to its level) have come down to 600,000 cubic feet per minute, which amount the channel will continuously disharge."

In my report of December, 1872, on a project for the drainage of this district submitted to me for inquiry, I entered as fully as the data then available admitted, into the calculations of the quantity of water, for the discharge of which it was necessary provision should be made.

Since that report was published, further observations have been taken with the view of determining the quantity of water that in certain periods accumulates above Enniskillen after heavy rainfalls, which was an important element in the calculations referred to, and though these observations show that the accumulation is somewhat less than I then calculated, they practically confirm the result at which I arrived.

These calculations have been very fully detailed in my former reports, and have, with other observations and information previously obtained with reference to this district, formed the basis upon which Mr. Barton has matured the design now submitted for consideration, and which will, in my judgment, be found efficient for the relief of the low lands in the district from floods, with the exception of those resulting from extraordinary rainfalls, which are of exceptional occurrence, and of such short duration that it would not be prudent to incur the additional expense necessary to provide for their discharge at a level below that of the lands.

Objections have been made by many persons interested, as residents on property adjoining the Lower Lake, or as traders using it as a navigable communication, to the reduction of 2½ feet proposed in the summer or low level of its surface, and it certainly is most desirable to avoid, as far as possible, any lowering of that level which is not essential for securing the efficient relief from flooding of the low lands in the district, or which can be avoided by any reasonable increase in the outlay necessary to effect that object.

In Mr. Forsyth's valuable report on this district of 1847, he states :—

> "There is perhaps, all things considered, seldom more water to be discharged at Belleek than what I have stated as the maximum discharge from the Upper Lough, but to guard against error, I assume that the greatest quantity to be provided for is 800,000 cubic feet per minute, and observation proves it seldom, if ever, reaches that maximum. This influx into the Lower Lough would raise its surface 12 inches in twenty-four hours, supposing no discharge from it took place, but if provision be made at Belleek for the discharge of 600,000 cubic feet per minute it would require four days to raise the surface of the lough to that extent, proving its useful effects as a compensator."

The careful register which has been kept at Belleisle of the daily rise and fall in the surface of the Upper Lake during the last seven years, and the measured discharge of the effluent water at Portora, taken at different heights and inclinations of its surface, have afforded data for calculation, which show that the influx of water into the lake and river above Enniskillen has not, during the years I have referred to, amounted to more than 550,000 cubic feet per minute for a longer period than four consecutive days, except on two occasions, one in October, 1870, and the other in January, 1873, and that influxes exceeding 650,000 cubic feet per minute have not been frequent, and are of much shorter duration.

The rapid discharge of the flood waters from the catchment of the Lower Lake, owing to the steep declivity of its slopes, will, no doubt, frequently cause the concurrent influx of a second flood from the catchment, and a maximum discharge of a first flood from the Upper Lake, but the former will pass off quickly, and it is not probable that the influx of water into the Lower Lake after heavy rainfalls will amount to a larger average quantity than 750,000 cubic feet per minute for a greater length of time than five consecutive days, though it may occasionally for short periods exceed 800,000 cubic feet per minute.

If the low level of the lake be fixed at 50·50 feet, the average discharge which will take place while it is rising to the proposed maximum height of fifty-two feet over datum, will be 511,000 cubic feet per minute, and taking the average influx of water at 750,000 cubic feet per minute, the quantity detained in the lake would take five days to raise it eighteen inches, and before the expiration of that period observations show that the influx would gradually reduce to a considerably less quantity. This appears to me to be sufficient storage to provide, and as the effluent water from the lower lake will seldom be discharged under a less head than 50.50 feet over datum by means of the outfall proposed, it is all that will be available as a reservoir under ordinary circumstances. The promoters of this project are, however, very desirous that they should have the power of reducing the Lower Lake to the level of 50·00 feet over datum, which, though six inches less than first proposed, will still be two feet below its present summer level, and I think there can be no reasonable objection to meet their wishes in this respect. Though this reduction of the level of the lake will not be detrimental to the principal lines of navigation, owing to its general ample depth, it will render necessary the extension of many of the existing landing quays, and the removal or buoying of shoals on the various lines of communication used by those resident on its shores.

The arrangement proposed of placing at Belleek the sluices by means of which the waters of the Lower Lake, and indeed the effective relief of the district depends, varies from that provided in the project on which I have recently reported, but there appears to me no reason to apprehend that it will be less effective.

The diversion of the road and the erection of a new bridge over the river at Belleek, has been proposed with a view to improving that outfall, and in the anticipation that, as it would be a local improvement attended with much public advantage, the adjoining counties would be liable to contribute a large portion of the expense; but as it is not a work essential for the drainage of the district, I recommend that it should be omitted, and provision made for the additional excavation in improving the outfall which will be rendered necessary by retaining the old bridge. If, however, during the progress of the works, the counties should wish to take advantage of the opportunity to reconstruct the bridge, it will be open to them to make arrangements to effect that object.

The extent to which the improvement of tributary rivers have been included also require some revision. I am of opinion that, unless in exceptional cases, the limits of the district should be determined by the extent to which the direct influence of the floods in the lakes extend, and as in several instances, they have been included far beyond that limit, I now recommend that the works and lands on the following portions of these tributaries should be struck out:—

The portion of the tributary to the Finn River, which passes under the Ulster Canal, above Clonfad Bridge.

The small tributary to the Swanlinbar River, lying to the south of the town of Swanlinbar, and also the portion of the tributary which flows into the lake immediately south of the Swanlinbar River, above Carraclare Bridge.

On the Rag River, all above Killywilly Bridge.

On the Hollybrook River, all above Aughalurcher Bridge.

On the Arney River, all lands and works on a small tributary which unites with it on the north side, a short distance below Drumsnane Bridge.

On the Sillies River, all above Stenson's Bridge.

The sluices, by means of which it is proposed to regulate the levels of both lakes, are to be ordinary lifting sluices of sufficient capacity for the discharge of floods within the levels stated, and should be constructed so as to admit of the impounding of the waters on both lakes at or near their maximum height, on the approach of the dry season of each year, and thus maintain, under suitable regulations, a reserved supply for the mills and fisheries on the river during the summer season, and preserve as far as possible the required depth of water for navigation.

I have checked the quantities of work to be executed, and have carefully considered the prices at which it is reasonable to calculate it can now be performed, and the estimate, as now revised, amounts to £169,577 18*s.* 10*d.*

The cost of the works necessary for the drainage of the district is largely increased by the necessity of maintaining, unimpaired, the existing navigation, in addition to which special works have been provided for its improvement and extension, for which great facilities will be afforded during the execution of those works necessary for the drainage of the district, and in the estimate which has been submitted, a sum of £31,946 19*s.* 1*d.* is set down as the proportion of the total cost of the works which is considered fairly chargeable to navigation, but I have not extended my inquiry to any such apportionment of the cost of the undertaking.

A very large number of objections have been made to the valuation, and its revision has consequently occupied a considerable time. As now revised, the extent of land included in the district is 19,417½ statute acres, the present annual value of which is estimated at £11,031 3*s.* 1*d*, and the increase in value at £7,327 4*s.* 3*d.*, which is, in my judgment, a moderate estimate of the improvement in the annual value which will result from the execution of the proposed works.

This project coincides, in its main features, with the design submitted by Mr. Forsyth to the Commissioners in December, 1847, and is similar to that which was prepared by Mr. Barton in December, 1870. The observations and careful investigations which he has since made, have enabled him to perfect the design now submitted, which will, in my opinion, be found to meet satisfactorily the demands of all the interests involved in the district, and is entitled to the favourable consideration of the Commissioners.

I am, sir,
Your obedient servant,
SAML. ROBERTS, Inspector.

The Secretary,
Office of Public Works,
Dublin.

APPENDIX No. 6.

REPORT UPON THE DRAINAGE AND NAVIGATION OF LOUGH ERNE AND ITS TRIBUTARIES,

As laid before the Committee of Owners of Flooded Lands, at Enniskillen, January 5th, 1871.

By JAMES BARTON, Civil Engineer, A.B., M.I.C.E., etc.

Dundalk, *Dec.* 30*th*, 1870.

To the Committee of Owners of Flooded Lands upon Lough Erne.

My Lords and Gentlemen,—I received in March last your instructions to investigate the best mode of relieving the flooded lands around Lough Erne and upon its Tributary Rivers, without injury to the navigations; and a number of reports by various engineers, during the past thirty years, upon the subject were put into my hands, with your desire that I should give such a preliminary report and estimate as would enable you to determine whether or not you would apply to have the district constituted under the Drainage Acts, and a Commission formed. The officers of the Board of Works having, under Mr. Forsyth, prepared rather voluminous sections as well as plans of the flooded lands, I hoped these would have been sufficient to enable me to make the necessary calculations of the channels and works required; and having made copies of these, I hoped to have reported in two or three months. When, however, I came to deal with the question, it became soon apparent that, from various causes, the sections then made, though very carefully prepared, could not now be used with safety; and moreover, that the necessities of the case required a far more extended series of sections of the channels, and long and intricate calculations of the discharge which, under various circumstances, would take place, from the several parts of the channels, especially between the Lower and Upper Lake.

Accordingly, I have had cross-sections made of the channels, and laid down on the accompanying drawings, 337 in number. Also, longitudinal sections and special plans, where the heaviest works are required. I have also had observations of the level of the lake waters taken at several places, and the rainfall observed at Crom, which, with the previous observations of others, and the rainfall registered by the Earl of Enniskillen for the past sixteen years, and kindly furnished to me, have enabled me to calculate, with some approach to accuracy, the necessary works.

So much has been said and written upon the general features of this subject, and upon the immense advantages to be derived, in a variety of ways, from the successful eventuation of a Drainage and Navigation project for Lough Erne, that in writing to those intimate with the lake, as you are, it is unnecessary to enter upon them.

The leading points may, however, be briefly stated thus:—

The Upper Lough Erne, between Enniskillen and Belturbet, receives the drainage of eight principal rivers, each with its tributaries, carrying the waters of a large district, and discharging these waters, at very low velocities, into the lake. The summer level of the lake is generally two, and two and a half feet, under the general level of the low grass lands around it, which extend very widely.

These lands are submerged for several months in the year, and occasionally the water is five to six feet deep over parts of them, as the floods rise occasionally to eight or even nine feet over summer level, and, since my observations, did rise to 7′ 7″ on October 31st.

By your instructions I have included, in the project I have to lay before you, the drainage of the lands along the tributary rivers for a considerable distance up each of them, and the amount of land thus proposed to be relieved, beyond the extent included by Mr. Forsyth in 1848, is over 2,300 acres The lands to be relieved below Enniskillen are comparatively small. The total lands included in Mr. Forsyth's estimate in 1848, was 17,554 acres; and with the above addition, the total quantity now proposed to be relieved is, as closely as possible, 20,000 acres of valuable land, now more or less injured by water, and which it is proposed may be drained, so that the occupiers may calculate on having their crops, and be able to grow either improved grasses, or cultivate as arable land.

A vast amount of miasma from the flooded lands would also be thus prevented, and so a benefit would be conferred upon a large portion of the community outside the limits of those who are landowners; and the cases of sad destitution and misery which have often arisen from the sudden destruction of the whole crops of a poorer tenant would be avoided.

The navigation of the lakes forms necessarily a part of this project. The summer level of Lough Erne prevents the passage of barges or steamers beyond Blocksom's Ford, on the way to Belturbet, and beyond Castle-Caldwell, on the Lower Lake, and is also hindered by a number of shoals in the main channels in a variety of places. It is proposed in dealing with the outfalls for drainage, to include a navigation six feet deep in summer to the canals at Wattle Bridge, also up the Woodford River to Aghalane Bridge, and to Belturbet, as also to render possible a further use of both the Finn and Creeve Rivers for the same purpose; also to improve the navigation of the lakes, by erecting beacons upon shoals and rocks, by which increased facility for trade would be given, as well as for tourist and pleasure traffic. The amount, by Mr. Brassington's valuation in 1848, of increased annual value upon the 17,554 acres then proposed to be relieved, was £6,728 per annum. Mr. Brassington, being now again consulted, has estimated that a new valuation would show an increase in valuation of land injured by floods, and upon improvement, of £20 per cent. upon his valuation of 1848. This would give an annual increased value for 20,000 acres of £9,198.

I have considered with some care the various suggestions of engineers who have already reported upon this subject, from Mr. Rhodes in 1840, to the last project by Mr. Lynam. There are in these reports a variety of suggestions, some very valuable, and the result of careful consideration, others less so; the estimates and the conclusions arrived at are very various. The report by Mr. Forsyth, of 1848, is that which enters most fully into the principles which should govern an effective project for Lough Erne, and with those principles I venture to express my own general agreement.

The foundation of any reliable project for prevention of floods must be a correct estimate of the quantity of water to be discharged in the time of high floods. This I find investigated by Mr. Forsyth, for the two main outfalls, namely, at Portora into the Lower Lake, and at Belleek. Mr. Forsyth estimates that the greatest flood at Portora is equal to a rise of ten inches in the Upper Lake, with the quantity at that time being discharged, this ten inches being the greatest rise he had observed; and from this he calculates upon a maximum quantity as somewhat under 700,000 cubic feet per minute to be discharged at Portora into the Lower Lake. As, however, there is no other recorded rise of ten inches, and as we do not know the river discharge on that occasion, it is important to obtain some further data to determine this most essential point.

The discharge of five other rivers in Ireland, all discharging from districts of over 300,000 acres, is thus stated:—

—	Acres	Maximum discharge per minute, cub ft.
The Boyne, ...	340,000	0 50 per acre.
The Brusna, ...	305,000	0 88 ,,
Lough Oughter and Gowna (part of Erne district), .	309,000	0·83 ,,
Lough Corrib, . . .	780,000	0·89 ,,
Lough Neagh, . . .	1,411,000	0 51 ,,

The larger districts necessarily show at the outfalls less effects of sudden floods, inasmuch as the waters of floods in the distant parts of a large district take several days to reach the outfalls, and when they do so, the great floods near the outfall have passed off.

Thus Lough Neagh, the largest district, gives a maximum flood discharge less than any other, the amount is largely affected by the Lake impounding its floods; but as Lough Erne comes not far from it in magnitude, it seems by comparison, and knowing the nature of the districts, that 0·75 cubic feet per acre of its watershed above Portora, of 805,750 acres, would be a probably fair estimate; this would be 604,320 cubic feet per minute.

Another, and perhaps more reliable, ground of calculation is to be had by observation of the discharge itself at the highest flood levels. The Upper Lake in flood-times having insufficient vent by the channels to the Lower Lake, rises, and the flood waters are spread over a large tract; and then this again rises with increasing floods, whilst the Lower Lake, being of so much larger area, rises less, until at last the fall from the flood level of the Upper Lake to the Lower becomes much greater, and consequently the velocity of the current and the depth of water in the channels is also so increased that the maximum is reached, and the lake ceases to rise, when the whole water is discharged—as fast as it comes in. The discharge at this maximum will be generally somewhat under the full flood to be vented, because the largest flood may not often occur when the height of Upper Lake is close to its maximum, but may have been expended in raising the Upper Lake when it was comparatively low; but it will be evident that a very great flood coming when the water is very high will give the greatest rise, and will produce exceptional cases of high floods; and in these exceptional cases, and a little beyond what they would give, I would expect to find the limit of discharge to be provided for.

I have, by a variety of calculations which I have had worked out, obtained sufficient data to say approximately what the level of water would be at Kellyhevlin Channel, and what at Portora Channel, when any known level exists at the Bridge of Enniskillen; therefore, having the highest flood level at Enniskillen Bridge observed, at many different times of flood, I have a means of approximating the maximum flood discharge.

The observations of the greatest height at Enniskillen Bridge I may tabulate thus.—the summer level I take as 152·86 feet over the Ordnance datum; and I find the height over that summer level—

In the year	1833,	greatest height,	5·4,	observed by Board of Works at Silver Hill, and 40 added for Enniskillen.
,,	1846	,,	3 5	Mr. Forsyth's Report.
,,	1847	,,	4·25	Do., as shown on sections attached to it.
,,	1848	,,	4 85	Do., marked as great flood.
,,	1852	,,	7 08	Given by Mr. R. Gray in Report.
,,	1867	,,	5 9	Taken at Silver Hill by Mr. Lynam, and ·40 added.
,,	1870	,,	5·7	My own observations.

Of these it will be seen that one flood observed by Mr. Gray in 1852 is more than one foot higher than any other observed by any one of those whose observations I have. The flood at the end of last October was a very high one, but it only registered 5·7 at Enniskillen; whereas that noted by Mr. Gray in 1852 was 7·08, or 1 foot 4 inches higher. I think, therefore, that such a flood is one of those exceptional cases which will give about the maximum water to provide for. Mr. Gray in his Report gives the velocity in both Killyhevlin and Portora of a flood within three inches as high as this extreme one; and I have calculated by those velocities; and as nearly as I can get results from them, I find the quantity probably discharged at this extreme flood was about 550,000 cubic feet per minute.

Again, I have measured the quantity passing through Portora, myself, in a flood four feet over summer level, which is nearly as high as the floods observed by Mr. Forsyth, as shown upon his sections, and the quantity was 435,918 cubic feet. If we suppose that flood to be increased three feet to the maximum observed by Mr. Gray, and the velocity the same, the discharge would be 602,838 cubic feet per minute.

Again, by a series of comparisons of the rainfall with the amount the Upper Lake rises, and the time it takes to fall in a dry time, I have a calculation giving a result of 601,000 cubic feet per minute.

By all these modes of calculation I am led to conclude that 600,000 cubic feet per minute will be a safe flood discharge to calculate upon at Portora, with this contingency, that in some particular states of the Lake, and coincidence of a second flood near Enniskillen, with the time when the waters of the first flood were arriving there, there would be a discharge of probably 650,000 cubic feet per minute; and upon this conclusion I base my calculation of the channels required between Upper and Lower

Lake, deducting for the Sillies River above Enniskillen and the Arney where it comes in.

The Belleek outfall has to discharge a large watershed, in addition to the quantity discharged at Portora. The drainage of 974,000 acres passes at Belleek, which, at the same rate as the above, 0·75 cubic feet per acre, would give a discharge of 730,000 cubic feet per minute, Mr. Forsyth's estimate is from 700,000 to 800,000; and I am of opinion that, from the steepness of the sides of the Lower Lake, floods from its small rivers would pass off before any very large flood would have time to reach from the Upper Lake; but here, again, provision must be made for the concurrence of second floods below; and therefore we should assume, I believe, that 730,000 cubic feet per minute should be provided for either by channels from Rosscor to Belleek, or by allowing room for floods to be impounded for a time in the Lower Lake, and if all sudden floods can be impounded there, the channels would be sufficient if, as at Portora, they would convey away 600,000 cubic feet per minute.

When the waters of the Lower Lake are rising the two feet from summer to flood level, the channels I propose will discharge about 500,000 cubic feet, and in a flood equal to 730,000 cubic feet there would thus be 230,000 cubic feet per minute to store in the Lower Lake. This quantity would take seven days to raise the Lower Lake two feet, and that number of days may be calculated upon as sufficient to allow the flood to pass and to come down to 600,000.

By using the Lower Lake as a vast reservoir for large floods, and allowing it to rise two feet in floods, the channels from Rosscor to Belleek, and the discharging channels and sluices there, may be, in my opinion, safely made only sufficient to carry 600,000 cubic feet per minute; and when I explain to you, further on, the large outlay necessary to make outlets even for that quantity, you will perceive that this reservoir for floods in the Lower Lake is that which alone will enable a really effective drainage to be carried out at any reasonable expenditure.

Passing from the main outfalls to the rivers, the quantity of water to be provided for in time of floods for them per acre must be larger, and I have taken it for the Finn River, Woodford River, Swanlinbar River, Upper Erne, Colebrooke, Arney, and Sillies, at various quantities, varying from 1·5 cubic feet per acre down to 0·83 cubic feet per acre.

The discharges being thus established, the next question for the main channels is the amount of fall in each portion of them—and on this subject so much has been said and written about the importance of an unbroken water surface for navigation from Belleek to Belturbet, that I must needs turn aside from the main question to explain what is involved in such a proposal.

In summer the two lakes are (and if no artificial break be made will always be) at practically the same level. Some observers say in dry summer the Upper Lake is 5 or 7 inches over the water at Belleek, and that, or less, is probably sufficient to discharge the summer waters. It is manifest that if the navigation of the Upper Lake is to be preserved without very heavy works in it, the summer level should be kept as high, or a little higher than now, therefore the Lower Lake (if there be no break of surface) must be maintained at the summer level of the Upper Lake; and as the level of the Upper Lake in winter must not rise much over two feet above summer level, the whole fall in floods from Upper to Lower Lake would be thus limited to about two feet. The excavation of channels to discharge 600,000 cubic feet of water between the Lakes, with a fall of only two feet, would cost far beyond any estimate I have seen of Lough Erne Works. The difference between the amount of excavation necessary for discharge with 2 feet fall and with 3 feet 6 inches fall, as I propose, would be very large; and besides this, as it is necessary to provide for 650,000 cubic feet per minute occasionally, these channels must, in the case of no reservoir in Lower Lake, be still further increased for this purpose. Moreover, if the level of the Lower Lake is to be the same as the Upper in summer, it is evident it cannot be used as a reservoir in the way already mentioned, and so the channels from Rosscor to Belleek should in that case be increased from carrying 600,000 cubic feet to carry 730,000 at least, or possibly 800,000, as Mr. Forsyth estimated for occasional floods; the effect of which would be a further increase of cost, by a very large amount.

I am aware that a letter from the Chairman of the Board of Works did propose to abandon the project of a lock at Knock Island (as proposed by Mr. Forsyth); but with that I have nothing to do, further than to state to you that in my opinion that change of opinion was not upon sound scientific and practical grounds, and any attempt to carry out the project with this view will, in my humble opinion, end in disappointment and vexation. To have a uniform water surface for navigation, and not to lower the level of the Lower Lake, are two points so *prima facie* desirable, that for some time after I entered upon this question I turned it over in every way, in the hope of devising means of doing so; but I was forced to the conclusion, which I stated to Mr. Roberts on the occasion of his late investigation, that any effective plan for drainage, within reasonable outlay, which would not destroy the navigation of the Upper Lake in summer, must use the Lower Lake as the economic natural reservoir for flood waters, and must therefore both lower it somewhat, and provide a lock and sluices between the Upper and Lower Lakes. I stated that Mr. Forsyth's opinion I felt bound to endorse, where he states:—"*I venture temperately to affirm that, to maintain a uniform level at all times of the year from Crom Castle to Belleek, without either ruining the navigation in summer, or submerging the low lands in winter, is wholly impracticable, within a reasonable outlay.*" Mr. Roberts, in his very valuable Report just published, quotes the above passage and says:—"I fully concur with Mr. Forsyth in the opinion he has so strongly expressed."

There is some needless alarm upon the subject of lowering the level of the Lower Lake. This alarm arises from a fear of shoals and unknown rocks in the way of navigation. The amount which the Lake will be lowered will, as hereafter explained, be between two and three feet, and I propose to beacon the shoals and rocks near the navigation so as to render navigation much safer than at present; and as there is no part of the line of navigation which will not be still amply deep, the inconvenience will be confined within very small bounds. The objection felt to stony fringes left by lowering will not, I expect be found practically to exist after a few years, inasmuch as the range of water level will be brought down from six to two feet, and so there will be much smaller fringes than heretofore. A reference to the Admiralty chart of the Lower Lake will show how steep its shores are, and how generally deep the greatest part of its expanse is.

I now proceed to describe the works which I propose, and which are shown upon the accompanying drawings.

I propose to purchase at Belleek the eel weir at the falls, and Mr. Bloomfield's eel-weir below the Railway bridge, and to remove the eel-weir at the falls, and construct a new one in the position shown upon the plans, or in a more eligible site if it can be had, and to sell the two eel weirs when their value, after the works are completed, is ascertained. Upon consideration, I think this the fairest and safest course, inasmuch as any new eel-weir instead of that at the falls must necessarily affect the value of Mr. Bloomfield's eel-weir below, either to increase or diminish it; and that in ways incapable of being valued beforehand.

I then propose to lower the water wheels of the

Belleek Pottery 4½ feet, and the head and tail races; and in order to effect this without interference with the factory, to provide temporary power to carry on the machinery, either by erecting a sufficient steam-engine, or by some mode of utilizing the water-fall; also to purchase the mill power on the south side of the river, which is small, and some portions of land necessary for the works. A cutting will then be made through the rocks of the falls, 100 feet wide, with so rapid a fall that at eight feet deep it will discharge 600,000 cubic feet per minute; and this cutting will end at the head of Belleek Island, where, and between it and White Island, six sluices, of twenty feet opening each, will be constructed, to be worked by suitable machinery; and though possibly it may be advisable to make them self-adjusting, yet in any case they should be under the control of a man in charge, whose house would be built upon Belleek Island. The exact form of these sluices I do not determine; this can be arranged hereafter.

These sluices would, when shut in summer, maintain the Lower Lake at the level of 149·36 above Ordnance datum; and whenever the waters rise in the Lower Lake at Rosscor above that level, one or more of the sluices will be opened so as to maintain it at that level as long as possible. When all the sluices are open, the increase of floods will raise the Lower Lake until it comes to be two feet higher than in summer, or 151·36 above datum, at which, or before which time, I expect the channels I propose to form will carry off the floods, so as to prevent the Lower Lake rising higher than about two feet.

In high floods, when the water rises to that level, there will be a fall of 3 feet 9 inches in the surface of the water from the Lower Lake to the pond above sluice gates, so that the water going to the Pottery race will be lower in such floods than at other times. I propose to give the factory the same fall as at present at such times, so that in summer there will be an increased head of about 1 foot 6 inches.

The works at Belleek, as above described, come to £12,398 6*s*. 8*d*.

From this to Rosscor, where the Lower Lake begins, three heavy cuttings have to be made, extending nearly the whole distance of three miles; and, although I have only estimated for discharging 600,000 cubic feet of water per minute as above, and have made the channels as economically as I could, and given so large a fall, yet the amount of excavation to give the required outlet is a channel 200 to 230 feet wide, and 10½ feet under floods, and the quantity of work is 981,641 cubic yards; and the estimate, besides cost of dredging plant for this portion of the work, comes to £44,232 8*s*. 2*d*.

This amount is much over the estimates of other engineers; and finding it so, I have had the sections and calculations repeated carefully, and find I cannot put forward a lower sum, for which I can assure you the work can be done.

I have already stated that I propose to use the Lower Lake as a reservoir to the extent of 2 feet over its surface; and this I propose to use not only as storage to enable me to limit the channels to Belleek, but also to limit, on account of these two feet, my Upper Lake channels to 600,000 instead of providing for an occasional flood of 650,000, as otherwise would be necessary. And the reason why I believe I may safely do this is, that the Lower Lake will be maintained in all ordinary times by the sluices at summer level; and when it is at this level, and until the Lower Lake has risen more than one foot, the channels I propose from the Upper Lake will discharge 670,000 cubic feet per minute.

The works, therefore, at Portora are confined to providing a channel which will discharge 600,000 cubic feet per minute. This I propose to do by a cutting 170 feet wide at bottom, and 10·7 feet below flood level.

The East Bridge of Enniskillen and its channel will carry so small a proportion of the whole flood waters (without a very large expenditure), that I have found it expedient to do but very little to it, merely to underpin the bridge and deepen its worst shoals, and I thus confine the heavy works to the West Bridge channel; here I propose to take down and rebuild the present bridge with an additional arch; or, if thought desirable by the town, a handsome suspension bridge in one span, with an entrance archway in keeping with the Castle, may be constructed for the same money, and would give better room for navigation.

The cuttings here, and at Castle Island and at Rossory, are also greater than those in previous estimates.

Killyhevlin will require a channel 200 feet wide and 14·75 feet below flood line; and at Lisgoole and other shoals between Killyhevlin and Knock Island, cuttings have to be make which seem not to have been observed, or calculated, in other estimates, but which must be cut, if the water is to be discharged.

At Knock Island I propose, upon the Blackrock side, to construct a lock 150 feet long and 25 feet wide, with a fall in summer of three feet six inches, and alongside of it four openings with sluice gates something similar to those I propose for Belleek, and upon the east side of Knock Island, in the wide open above Ring, to construct four more openings for sluices, and 520 feet long of a regulating weir, which would be submerged in floods. This weir and these gates, when shut in both channels, would maintain the waters of the Upper Lake at a level of 152·86 over Ordnance datum, and six feet above the sill of the lock at Wattle Bridge, and so ensure the navigation being unimpeded. Along the west side of Knock Island a considerable excavation is necessary, and some rock has to be removed. Above Knock Island, both channels to the Upper Lake have to be dealt with; that by Carry Bridge requires the underpinning of that bridge and the removal of the shoals near it—the construction of a new bridge at Belleisle Avenue, and the removal of shoals on both sides of Belleisle. In the east channel the shoals at Drumcramph and at the mouth of the Arney River have to be removed. The total cost of the works, from the Lower to the Upper Lake, I estimate at £53,985.

I now proceed to describe briefly the works proposed to be executed upon the rivers and Upper Lake channels.

The Upper Erne.—I propose to lower the shoal between Innisfendra and Gubb to 6 feet below summer level, and to form a navigation channel through the shoals at Quivey Lough, Foalies, Blocksomsford, Pink Grove, and Belturbet, up to the Quay there, and that the district should end there. The areas of the excavation will, besides the navigation, give the required vent for the waters to drain that large district The cost of these works will be £1,906 7*s*. 6*d*.

The Woodford River.—This river only requires the removal of the shoals at Corraback and Killynick to complete its navigation to Aghalane Bridge, where again I propose the district to terminate. The cost of this work I estimate at £236 2*s*. 6*d*.

The Finn River has a very considerable quantity of flooded land, and the works I recommend include relieving these up to Annalore mill, beside Mr. Forster's of Ballynure. The works to be executed on this river are so considerable, I was obliged to make a very large number of cross sections and calculate its channels very much in detail, the fall being very small. I propose to excavate the channel and remove shoals at the following places, which I have shown also upon the plans and sections:—Ballynure, Gortgranard, Scarvy Bridge, Clonkeen, Cumber Bridge (where I propose to buy up the fall used at the mill there), Corraskea, Annies Bridge, Cloncallick, Ballyhoe Bridge, Annaghraw, Fostry, Annaghmullin Bridge, Drummully, Gortnacarrow Bridge, Drumcrin, and Wattle Bridge.

The cost of removing these shoals and underpinning the bridges where they require it, from Wattle Bridge to Cumber Mill, I estimate at £5,997 12*s.* 6*d.*; from below Cumber Mill to below Annalore Mill, £1,400 11*s.* 8*d.*—the additional land relieved being 243 acres, for *this last* amount.

There are two tributaries of the Finn River which I propose also to deal with. One runs under the Ulster Canal, and its improvement will relieve 253 acres, at a cost of £708.

The other runs by Crockerahoas Bridge, and its works will relieve 134 acres at a cost of £276 9*s.*

The Moorlough River is to be relieved as far as Screevagh Bridge; the channel to be cleared and deepened; the bridge at Screevagh and some gullets underpinned; and a small tributary deepened and cleared. The acreage relieved, additional to that proposed by Mr. Forsyth, will be 317, and the additional cost £269 5*s.* The cost of works below this, from Derryany Bridge to the Lake, comes to £2,192 3*s.* 4*d.*

There is also a small tributary east of the Moorlough River, which I propose to deepen and clear up, by which a further quantity of 51 acres will be relieved, at a cost of £131 10*s.*

The Hollybrook River.—I propose, subject to future modification, to carry out the proposal for this river made by Mr. Forsyth, to cut a new channel from Garvaghy Ford into Kilmore Lough, so as to free the navigation from the sand coming down that river; also to deepen the navigation to Lough Head, where it requires it, to five feet in summer. The cost of these works will be £2,133 6*s.* 8*d.* I also propose to extend the works on this river up to Macknagh Bridge, by which 174 additional acres will be relieved, at an additional cost of £342 12*s.* The Colebrook River is to have the shoal at its mouth removed, and the Aghavea stream deepened, the cost of which I estimate at £2,041 10*s.*

The Swanlinbar River.—I propose to remove the shoal at its entrance into the lake, and to follow a tributary of the Swanlinbar River, upon which there is about 157 acres of flooded land, lying south of the town of Swanlinbar; to deepen and straighten its channel, and underpin the bridges. The costs of these works I estimate at £393 17*s.* 6*d.* The land relieved will be 157 acres.

The Rag River I propose to improve by purchase of Drumrush Mill, and removing its weir, underpinning bridges and gullets, and making large excavations between that and the Lake. The additional extent of river now proposed to be improved will relieve 193 acres, at a cost of £596. The works below this to the lake will cost £2,689 0*s.* 10*d.*

The Arney River I propose to improve by clearing and deepening channels, underpinning Belcoo Bridge, Brockagh Bridge, Arney new and old Bridges, rebuilding Drummane Bridge, which is nearly falling, and removing and replacing eel-weirs, up to Upper Lough Macnean. The total quantity of land relieved above Drummane Bridge would be about 492 acres, and the additional cost £1,527 16*s.* 2*d.* The cost of works below Drummane Bridge will be £306 5*s.*

The Sillies River.—I have confined my attention on this river, according to your instructions, to the short distance from its mouth to above Glencunny Wood to the townland of Coolyermer. On this length, the works below Steenson's Bridge will cost £219 17*s.* 6*d.*, and the extended works will cost £875 2*s.* 3*d.*; and the lands relieved by this last sum will be 152 acres. The chief works will be Steenson's Bridge, Drumrainy new Bridge, Garvary Bridge, Glenanny Bridge, and Oldskea Bridge underpinned; Gortas Mill and weir to be removed, and fords on river taken away.

The shoals at the mouth of the Kesh and Bannagh Rivers are to be removed, the cost of which is estimated at £370 16*s.* 8*d.*

The underpinning of a number of bridges is involved in the river works, and is not included in the foregoing, and is estimated at £1,200.

In connexion with the river works and the drained lands along the margins of the Upper Lake, it is proposed to clear up the main drains and small streams, coloured red upon the plans. These are divided, in the estimate, into three classes of size, at 11*s.* per lineal perch, 5*s.* 6*d.* do., and 3*s.* 4*d.* do.; and the quantity of each I could not, in this examination measure, and so take it as given by Mr. Forsyth. The total amount of these drains comes to £12,115 19*s.* 2*d.* This will leave only the minor drains to be constructed by the farmers.

I propose that two dredgers be provided, one with two outside ladders and large buckets capable of raising 3,000 tons a day of clay and boulders, with three hopper barges, one with engine and screw propeller, capable of towing itself and the others—these to work the main channels.

Also a small dredger for the Finn and other river channels, with single ladder capable of raising 500 tons a day, with two plain and one steam hopper barges in attendance. With these the works may be completed in four years.

These dredgers and barges I estimate at £20,300, and consider they should bring two-thirds of that amount, if sold in proper order at the close of the works.

The total of the works above described, as per annexed estimate, for both drainage and navigation, amounts to £155,847 8*s.* 7*d.*; and adding 10 per cent for preliminary expenses, management, and contingencies, and 6 per cent. as an estimate of the interest on capital which will accrue during construction, we get a gross total of £181,781 2*s.*

Of this I estimate that £31,188 9*s.* 2*d.* is properly chargeable to navigation. I estimate this upon the same grounds as Mr. Forsyth has estimated the portion chargeable to navigation—namely the amount which would have to be expended to make navigation channels only, with such works as sluices, weirs, &c., which are specially required to maintain the waters in summer for navigation purposes.

I have also estimated the amount chargeable to the counties for works done to the public road bridges, and which, under the Drainage Acts, the counties are bound to repay. As there has been some question raised about these amounts in some counties, I prefer taking Mr. Forsyth's estimate of 1867, as far as the bridges he proposed to alter is concerned, to a new one on this item; and adding, to the amount he gives the sums I estimate upon the rivers, where the works are extended, the total amounts to £7,535 6*s.* 8*d.*

If these amounts be deducted from the gross estimate, for navigation and drainage, the remainder—£142,994 6*s.* 2*d.*—remains as chargeable to drainage only.

The amounts chargeable to navigation have not hitherto, in other drainage districts, as far as I am aware, been charged to the drained lands; and it may be reasonably hoped that in this case, if two-thirds of the flooded landowners consent to be taxed for the amount properly chargeable to drainage only, the Government may be induced to grant moneys lying in their hands for many years, originally allocated for this very purpose.

Upon inquiry at the Board of Works, I was informed that they have no power to lend money for drainage purposes for a longer term than 22 years; and the interest and instalments added together, and spread over that term, gives £6½ per cent. per annum to be paid. This answers sufficiently in cases where the expenditure leaves a very large margin of profit; but here it becomes necessary to deal with the large expenditure proposed as an ordinary loan. I find that money is lent for 35 years under the "Land Improvement Act" through the Board of Works, and in that case the interest and instalments together come to £5 per cent.; and that money is lent largely to Harbour Commissioners for pier and harbour improvements for 41 years, in which case the interest and instalments together only amount to about £4½ per cent. I would suggest that your Committee should come to the decision to lodge the plans required by the Act, and to apply to the Board of Works to have the district constituted; and whilst the necessary time of notices is passing, and the investigation is being held by Mr. Roberts, that memorials be sent to the Board of Works to urge them to insert in a Bill which they are about to bring into Parliament provisions to meet both the grant for drainage, and to confer powers upon them to lend for 35 or 41 years; and if over two-thirds of the proprietors sign a consent to the works, for the amount properly chargeable to drainage only, there will be a strong case to lay before Government to induce their consent. Mr. Brassington states the value to be 20 per cent. higher now than when he made his valuation in 1848; and the increased value, by this estimate, would give 6½ per cent. upon the outlay for drainage only.

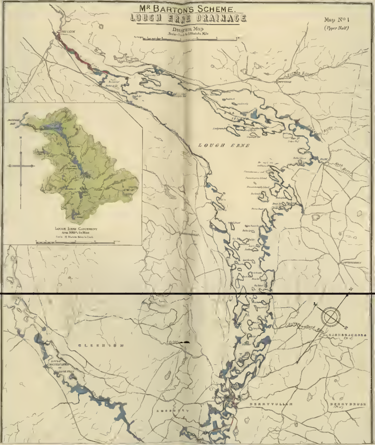
The plans are complete for lodgment, except that the valuation and division into tenements has yet to be done, and that copies must be made. I may be thought by many to have over-estimated the works required, to properly effect the drainage of the flooded lands; but I can assure the Committee that I am only anxious to state such a sum as will, I believe, really do what is needed to prevent the flood waters covering the grass lands along the lake margins, except in some very exceptional cases, and then only for a very short time, so that the farmer may be safe in the assurance that his crop will not be lost.

It may be that, in the process of construction, I can effect some economic changes which the present examination has failed to discover on so large an area; but if so, it will be more satisfactory to you, my lords and gentlemen, to have the works completed for a few thousands less than you agreed to spend, than to have to spend a much larger sum, as has been too often the case on other drainages.

I am, my lords and gentlemen,

Your obedient Servant,

JAMES BARTON.

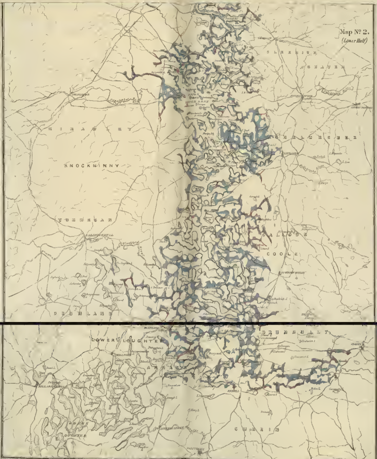


Mr Barton's Scheme.
LOUGH ERNE DRAINAGE

Diagram Map

Map No 1
(Upper Half)

Lough Erne Catchment
Area [illegible] Sq Miles
Scale [illegible] Statute Miles to 1 Inch


Map No. 2.
(Lower Half)
CLEENISH
AGHAVEA
AGHALURCHER
KINAWLEY
KNOCKNINNY
LOUGH ERNE
TOMREGAN
BALLYCONNELL
Woodford
GALLOON
COOLE
NEWTOWNBUTLER
DRUMLANE
DRUMMULLY
LOWER LOUGHTEE
MILLTOWN
ANNAGH
KILLASHANDRA
LOUGH OUGHTER
REDHILL
BUTLERS BRIDGE
CURRIN
BALLYHAISE
CLONES

APPENDIX No. 7.

LOUGH ERNE DRAINAGE.

Report by Mr. T. HAWKSLEY on Mr. PRICE'S Scheme.

30 Great George-street,
Westminster, 6th May, 1880.

SIR,—In conformity with your instructions of the 8th December last, I have duly held the local inquiry under "The Drainage and Improvement of Lands Act (Ireland), 1863," and other relevant acts in relation to the petition of John Grey Vesey Porter, Esq., praying that your Honourable Board will be pleased to constitute a drainage district in the Counties of Fermanagh, Cavan, Monaghan, and Donegal, in such petition and in the documents relating thereto provisionally described, and called by the short synonymous names or titles of "The Lough Erne Drainage District," and "The proposed Drainage District of Lough Erne."

The said inquiry was held, after due notice, in the Court House of Enniskillen, on the 6th and 7th days of January last, and was then intermitted (with the consent of all parties) to the 11th day of January, in order to enable me in the meantime to examine the upper and lower loughs and the course of the river connecting the same, and on such last mentioned day the inquiry was resumed and concluded.

I conducted the general inquiry in strict conformity with sub-sections 3 and 4 of sections 6 of the principal Act of 1863, and carefully made all the necessary special inquiries therein particularized and heard (upon oath), all the objections then appearing before me, and all persons appearing on their behalf concerning the subject matters of their several objections, and otherwise as prescribed by the said statute. Such special inquiries and hearings being chiefly directed as follows, that is to say ;—

1. With respect to the propriety of constituting such district.
2. As to the assent of the proprietors thereto.
3. With respect to the area of land to be comprised in the district.
4. With respect to the correctness of the schedules containing the names of the proprietors and occupiers of the land to be drained or improved by such (proposed) drainage.
5. With respect to the objections of persons interested in the lands or river, and of persons appearing on their behalf as to any omission or mis-description in the schedules or any name improperly inserted therein ; and
6. To the schedules, maps, plans, sections, and estimate ; and
7. To the proposed works ; and
8. To the stated value of the lands, or to the probable increase in such value, as respectively set forth in such schedules ; and also
9. With respect to the objections made by or on behalf of the owner, lessee, or occupier, or other person interested in any mill or factory likely to be affected by anything proposed to be done in the proposed district under any of the provisions of the principal Act.

And I have now the honour to report what in my judgment are the results of my inquiry, and submit the same to the consideration of your Honourable Board :—

1. That it has been satisfactorily proved that it will be proper to constitute the proposed district.

2. That the evidence leads me to conclude that the majority of the proprietors are desirous that such district should be constituted, and assent, or are willing to assent, thereto. The objectors were few in number, and those, for the most part, objected less to the main principles than to minor details, not importantly diminishing the desirability of the project.

3. The area of the land proposed to be comprised in the district is 17,405 acres, or thereabout. But this stated area is subject to certain small corrections, which it was agreed between the promoter and the several objectors, should be ascertained by Mr. Brady, on behalf of both parties. These corrections have now been received, and are approved by me. I therefore report that the amended area contains 17,266 acres, or thereabout.

4. A few errors in the names of proprietors and occupiers, as entered in the Schedules were alleged, and so far as I was satisfied thereof, the necessary corrections have been made, and are now submitted.

5. The same remark will apply to the few omissions, misdescriptions, and improper insertions of names in such Schedules, as the same were proved before me ; all these have been corrected by me.

I am of opinion that all reasonable care has been taken in the preparation of the Schedules, and respectfully submit, that considering the minuteness and complexity of the work, and that it was undertaken mainly, if not entirely, at private risk and expense, the slight inaccuracies which appear therein, and which are certainly not more than would occur in any ordinary Schedule of a like kind and magnitude prepared for a bill in Parliament, should not have important weight in the consideration to be given to the main question, upon which your honourable Board will have to decide. For practical purposes the Schedules may be taken as correct, and the more so because a provision for the future rectification of mistakes (if any) can be inserted in the provisional order.

6. No merely formal objections were made and established in regard to the existence of patent defects and inaccuracies in the schedules, maps, plans, sections and estimates, but scientific and practical objections were powerfully urged by Mr. Barton, C.E., (who appeared on behalf of Mr. Armstrong, an owner and occupier interested) to the proposed engineering arrangements, and in a slighter degree, and only as to particular interests, by two or three other parties.

To some of these objections I shall hereafter refer. The engineering features of the scheme, as it was presented to your honourable Board were devised by Mr. Price, C.E., admittedly on the lines of other engineers (notably Mr. Barton), who had preceded him in the consideration of the enterprise, but with many alterations, modifications, and departures from earlier ideas, adopted in part as substantial improvements, but perhaps mainly induced by considerations of economy consequent upon the failure of previous schemes, by reason, as was alleged, of their probable expense having been greater than the taxable district could reasonably incur.

The evidence adduced before me has however established to my satisfaction the great fact, that, subject to some enlargement of channel and other inferior reconsiderations of detail, the necessity for which was pointed out by Mr. Barton, the plan of Mr. Price may in my judgment be advisedly adopted without fear of that gentleman's estimate being unduly enhanced, and this the more especially because it was stated and not denied that the values of materials and labour had become greatly reduced since the values adopted by Mr. Price had prevailed.* Similar changes of details are invariably introduced into all important engineering constructions, and must therefore be allowed to have their place in a work of magnitude in which the difficult subject of the safe conduct of large bodies of water is the object to be attained. The Provisional Order (if granted) will, I presume, contain all necessary provisions for adaptation and deviation, and be framed in this respect in some conformity with the usual provisions of important Waterworks Acts.

An additional outlay of about £10,000 will in my judgment enable the work to be made sufficiently perfect and ample for the effectual drainage of the district, except perhaps during those periods of excessive downpour which occur at long intervals, and which from their exceptional character it would be unreasonable and pecuniarily improvident to provide against.

7. Some of the specific objections to the work proposed by Mr. Price have been sustained by Mr. Barton, but without thereby, as I submit, defeating Mr. Price's plans as to their main and most valuable characteristics. The want of Mr. Price's design is, as it appears to me, confined almost entirely to an easily remedied defect of capacity in some of the excavated channels by means of which the flood waters of the upper lough, and its tributaries are to be conveyed to the lower lough. The drainage area shedding to the upper lough is enormous, being computed to be nearly 850,000 acres, or about four times the drainage area of the lower lough, whilst contrarywise the receiving basin of the upper lough and its assistant loughs is only 12,000 acres, as against 27,600 acres of the lower lough. Thence, with equal rainfalls of flood producing power, the upper lough rises with great rapidity, and spreads itself over large areas of valuable margin lands, whilst the lower lough is being elevated in only a comparatively insignificant degree, until the increasing discharge from the upper lough comes in aid of the waters proper to its own catchment basin. The floods of the lower lough will, however, be materially controlled and instigated by the operation of the outfall works proposed to be established at Belleek.

No objections to the project proceed from the owners and occupiers of lands bordering the lower lough; it will therefore be sufficient for the immediate purpose to consider mainly the influences of heavy rainfalls on the upper lough and its outfall river. Both experience and calculation demonstrate that it would be useless to attempt to control the floods produced by abnormal rainfalls of two or three inches in twenty-four hours, for these, though frequently appearing in Meteorological records, are rarely found to extend at one time over areas of country so extensive as the watershed of Upper Lough Erne. It is, however, to be regretted that although Mr. Porter of Belleisle has registered a long series of daily observations on the height of the water in the upper lough, there have been no concurrent observations made at various points on its catchment basin to show the amount of rain by which the level of the lough is influenced, nor have any systematic endeavours been made to determine the simultaneous discharges from its outfall river. We must, therefore, fall back upon such comparisons as occasional opportunities offer for testing the soundness or otherwise of the data upon which Mr. Price has based some of his most important calculations. After much consideration I have arrived at the conclusion that the interests of the farmers will be adequately protected by any method of drainage which is capable of so restraining summer floods resulting from a rainfall of 1½ inches in 24 hours, that their rise shall not exceed 15 inches in that time, and that they will then begin to draw off.

Mr. Price, relying upon observations of the discharges of certain other rivers in Ireland, adopts for the rate of influx 0·63 cubic foot per minute contributed by every acre of land within the watershed area. This amounts in round numbers to 530,000 cubic feet per minute. But in twenty-four hours of the 8th and 9th September, 1879, the lough rose 13¾ inches (the largest rise in one day during many years), and on that occasion Mr. Eadie of Lisbellaw registered a rainfall of 1·40 inches in 24 hours. At the height at which the lough and its adjunct loughs, rivers, pools, and ditches then stood, the recipient area could not in my opinion have been less than 15,000 acres, the water therefore accumulated at the rate of about 500,000 cubic feet per minute over and above the quantity the river was in its then state simultaneously discharging. Mr. Price's factor (0·63)† thus provided for the quantity of accumulated water, but it obviously requires to be increased in order to represent (as it ought to do), the sums of the volumes accumulated and discharged in the maximum time allowable under the observed and actually occurring circumstances; unfortunately no corresponding observations were made upon the actual discharge of the river, at the time of this flood. Probably it amounted to more than one half the accumulated volume, for in the previous smaller flood of July, Mr Price estimated the maximum discharge at Portora at more than 300,000 cubic feet per minute coming from the upper lough. It is therefore certain that Mr. Price's factor (0·63) ought to be increased to (0·9) or (1·0), with a view to prevent in future injurious accumulations of flood waters, especially during the summer months, when the hay and other profitable crops are the most likely to sustain injury. This summer flood, which it may be admitted was, in regard to the rapidity of its rise and in other of its circumstances, somewhat exceptional, has however been frequently exceeded by the winter floods, its maximum height having been only about seven feet above the zero of the Belleisle gauge, whereas other floods registered by Mr. Porter attained much greater heights, the flood of January, 1873, reaching indeed to eight feet six inches, and the flood of January, 1877, to nine feet eight inches.

The following table has been extracted by me from the Belleisle records, politely furnished by Mr. Porter, a copy of which, together with Mr. Eadie's Returns of the Rainfall, I have the honour to append to this Report:—

Extracts from the Table of Observations at Belleisle, referred to a zero 182·86 feet above low water.

			Ft.	In.
In 1871, February, the Lough attained a maximum height of			7	9½
In 1872, December,	"	"	7	9
In 1873, January,	"	"	8	6
In 1874, December,	"	"	7	0
In 1875, November,	"	"	8	5
In 1876, March,	"	"	8	2½
In 1877, January,	"	"	9	8
In 1878, January,	"	"	6	11
In 1879, July,	"	"	6	3
September,	"	"	7	0½

It thus appears that in every one of the eight years preceding 1879, there were floods of equal or greater magnitude than those of that year, but that by reason of their occurrence in winter the injurious effects, though always very considerable, were not so disastrous to the farmers as on the two occasions closely following each other in the best periods of the last summer.

A careful consideration of the Belleisle Report, therefore, induces me to report that if the monetary conditions of the case will permit, a larger factor than

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[*] I have not reduced Mr. Price's estimate by crediting it with an allowance on this account, because a revival of trade may induce a return to previous rates.

[†] It is only just to observe that Mr. Price has adapted his factor to the case of a flood of four days' duration, whereas the flood of September indicates that a sudden rise of more than one foot in twenty-four hours, may succeed upon an accumulation of water due to an immediately preceding fall of rain.

that used by Mr. Price ought to be employed, I have consequently made such additions to Mr. Price's estimate as will enable his proposed channels to be sufficiently enlarged to confine the rise of future floods of similar magnitude within the limits I have already suggested, and also within the maximum height indicated on Mr. Price's deposited section, except in the case of those very extraordinary floods which, according to my experience, seldom occur oftener than four times in a century.

It also appears to me preferable to obtain the necessary discharging power by enlarged sectional area rather than by an increase of fall depending upon and to be obtained by a prior manipulation of the lower lough.

Be this question of expenditure determined, however, as to your honourable Board may seem best, great mitigations of existing evils must necessarily result (although floods will not be entirely prevented) from Mr. Price's proposed enlargement of the channel of the river, the removal of existing obstructions therein, and the lowering of its bed, where it is now too high to permit the free passages of the water from one lough to the other.

Exception has been taken to some of Mr. Price's calculations on the grounds that less than the estimated quantity of water will enter and pass through the improved channels. No doubt the abbreviated formula customarily adopted by hydraulic engineers might justify this inference, but seeing that it is an easy matter to expand the throats of the channels, and that a deep stream is well known to flow with a considerable greater velocity than those formula imply, I am not disposed to think that actual results will differ to any important extent from Mr. Price's calculations. Beside this it would certainly be unwise to refine overmuch in a case which must be dealt with for the relief of suffering interests according to broad views rather than with respect to more minute and critical considerations. My own estimation would indeed carry the capability of the proposed undertaking somewhat beyond Mr. Price's own anticipations. Moreover, objections of a minor character, even when well founded, can always be met and satisfactorily overcome by the responsible engineer when the time for proceeding with practical operations has arrived. I have in mind, whilst making these remarks, certain suggestions alleged against the sufficiency of the works of excavation to be executed at Black Rocks, Killyhevlin, Portora, and a few other places, but which, admitting their validity, did not appear to me to tell heavily against an otherwise sound and practicable scheme readily improvable within the limits of expense, for which I have provided.

No objections were made on behalf of the town of Enniskillen, nor on behalf of any riparian proprietors on the upper lough or rivers in respect of apprehended injuries to be done to them by the construction of the proposed works, nor after my personal examinations do I perceive any ground for reporting that such are likely to occur.

With respect to the outfall works at, and leading to, Belleek, an important objection was made, and, in my opinion, the designs for these works are, with certain intended modifications of size and strength, well suited to their respective purposes. The probable cost of these modifications I have also included.

8. A considerable number of objections were made as to the stated values of the lands to be rated, and as to the probable increase in such values as respectively set forth in the schedules. All these were duly heard and considered, and, where needed, proper corrections were made. A few depending on local knowledge were, by agreement with the parties, referred for examination and report to Mr. Brady, the Surveyor and Valuator engaged for the promotion of the scheme, and who appeared to have the confidence and respect of everybody concerned. This gentleman, with whom I had a personal conference on all the cases, has furnished me with his results, the whole of which I have incorporated with the schedules.

9. Some objectors appeared in respect of anticipated damages to, or abolition of, fish weirs and eel fisheries on the course of the river leading from the lower lough to and at Belleek. I heard the evidence and viewed the structures, and came to the conclusion that the cases are of an ordinary description, capable of being dealt with in the usual way, *i.e.*, by money compensation or re-instatement, but that, as these cases do not appear to fall within a critical construction of the language of the Act, they may be properly provided for in framing the provisional order. The objection of the proprietors of the Belleek Water Mills, on the ground of alleged injury to their water power, is in my judgment adequately met by Mr. Price's propositions.

Objections were also made by proprietors of water power at Ballyshannon in respect of apprehended consequential injuries to their mills by reason of the contemplated artificial adjustment of the summer level of the lower lough, which, as was alleged, operates in its present natural state as an impounding pond for the use of these mills. I am of opinion that these parties are needlessly alarmed, but that, if after the contemplated works are brought into use they should still remain of an opposite opinion, they may and ought to be then admitted to claim such compensation in money or otherwise as they shall deem themselves entitled to. These cases are also somewhat peculiar, inasmuch as the mills, one of which is connected with a distillery, are situated four miles below the lowest of the proposed works, and in consequence of being also out of the proposed drainage area are possibly beyond the scope of the Drainage Acts. These mills will still continue in receipt of the entire quantity of water yielded by the two loughs although perhaps in a somewhat altered form. A few words introduced into the Provisional Order will, however, suffice to protect the interests of, and will I believe satisfy the wishes of, the objecting parties.

In conclusion, I beg to submit:—

1. That although the scheme (unless amended as herein proposed) may not accomplish quite all that has been expected from it, because of the more than usual rapidity with which the catchment area discharges the rainfall into the Upper Lough Erne, yet that, in my judgment, the benefits which the proprietors and occupying farmers will derive from the permanent reduction of the height of the loughs during ordinary wet weather, and the prevention of the now usual and almost periodical floods are so certain and so substantial as to warrant your honourable Board in according their approval to it, and that, with the suggested amendments, it will be capable of accomplishing as perfect a drainage of the loughs and injured lands as can be effected by a reasonable and reproductive expenditure of capital on these works of permanent improvement; and

2. That, in my opinion, the navigation of the loughs and river will not be injuriously affected, and that the course of the vessels, passing into and out of the communicating canals, will be both shortened and facilitated.

I have the honour to be, sir,
Your most obedient servant,
(Signed), T. HAWKSLEY, C.E., F.R.S., &c.

E. Hornsby, Esq.,
Secretary to the
Commissioners of Public Works,
Dublin.

APPENDIX No. 7.

LOUGH ERNE DRAINAGE.

MR. PRICE'S SCHEME.

STATEMENT of a complete plan for DISCHARGING QUICKLY the FLOODS of LOUGH ERNE by clearing its SHOALS and CHANNELS from BELLEEK to BELTURBET; and also for providing for its COMMERCIAL STEAMBOAT NAVIGATIONS from BELLEEK to BELTURBET, with branches to first locks of the ULSTER and BALLINAMORE CANALS, by putting up suitable OUTLET-SLUICES at BELLEEK.

By JAMES PRICE, Mem. Inst., C.E., M.A.I.

PREFACE.

1. It is unnecessary to make any remarks upon the very great injuries sustained by large tracts of land lying along the margins of Lough Erne and its tributaries, caused by floods rising over them for long periods.

2. Whatever opinions some may entertain as to the value of flooded meadows, almost universal consent is in favour of the view that land is injured by uncontrolled flood and long continued submersion.

3. In the present case the area is 17,405 acres, capable of vast relief and improvement in value.

4. To prevent these floods will not merely be useful to the lands themselves, but also to the climate of the whole surrounding country.

PREVIOUS OBSERVATIONS AND PLANS.

5. Being employed by Mr. J. G. V. Porter, of Belleisle, to consider this question and prepare a plan which would combine the greatest relief with the most moderate cost, I have asked and received from him a vast amount of valuable information, collected with great care—in the first place, consisting of accurate daily observations of the levels of the lake, taken at Belleisle, a most suitable place, from 1867, upon which the several previous plans of drainage, to be referred to hereafter, have been based. Mr Porter has also furnished me with surveys, sections, calculations &c., prepared for him by Mr. Lynam (a Civil Engineer of long experience in drainage matters), from 1867 to 1874.

6. I have also been furnished with Mr. Forsyth's Report, 1847, ably embracing the whole subject, and with all the Reports made upon Mr. Lynam's 3 plans and Mr. Barton's plan by Mr. Samuel U. Roberts, M. Inst. C.E., then Inspecting Engineer, and now Commissioner of Public Works. It is hardly necessary to state that these Reports, embodying the opinions of an engineer of such eminence and special experience in drainage, combined with navigation, upon these various plans submitted to him, and on the question generally, now afford an immense amount of information and direction in the preparation of a plan; and I may here state that I have exactly followed the statements expressed in his Reports as to the amount and duration of the floods to be discharged.

7. I have also inspected carefully the plans and sections prepared by Mr. James Barton, M. Inst. C.E., for the Earls of Erne, Enniskillen, and Lanesboro', and other large landlords, on the shores of Lough Erne, who, when they signed as its first step, and promoted by their memorial their attempt, have shown their strong sense of the injuries inflicted by floods. Upon this plan great labour and care have been bestowed; it provides a complete system of drainage and navigation but at same time too costly for the value of the advantages to be gained, and beyond the financial means that could be obtained.

8. I have freely availed myself of all these sources of information, and now submit a more moderate plan than those last brought forward, yet little, if at all, inferior in the benefits conferred in case it be carried out; and though I may appear to differ from some of the views of these eminent engineers, the exigencies of the case compel me to adopt an independent course, otherwise it would be impossible to reduce the expenditure by taking advantage for all interests concerned from the discussions and experience of these previous plans.

NATURAL FACILITIES.

9. Though this question is of magnitude in its bearings the proposed work itself does not present engineering difficulties beyond an ordinary kind; on the contrary, there are great facilities which may be enumerated as follows:—

(*a.*) Large ponding areas available, whereby less cuttings are required, and the works can be carried on in summer without expensive dams, and free from the chances of sudden floods. No cuttings of very great depth; and, in general, the soil to be cut is not of a slippery or boggy nature. A moderate quantity of rock to be cut, neither of a hard kind, nor in difficult places.

(*b.*) Foundations for bridges and sluices good and solid.

(*c.*) No embankments to be made, which are always a source of great expense during formation, and of danger afterwards, and have run up the cost of some drainage districts (for example, Mulkear River in Tipperary) much beyond the estimates.

(*d.*) Ample "free" fall at Belleek.

10. In short, there is no case of arterial drainage of such magnitude in the kingdom where successful execution of the necessary works would be more easy.

AMOUNT OF COST ADDED IN THIS CASE BY THE NECESSARY IMPROVEMENT AND MAINTENANCE OF NAVIGATION.

11. Were it desirable only to prevent the floods and that navigation could be disregarded, the simple work of cutting a deep channel from Belleek to the Lower Lake at Rosscor would suffice, as the summer level of the Lower Lake would thereby be reduced nearly 5 feet. It would then afford so large a ponding basin that, even without any deepening of the channels between the two lakes, the present backwater of the Lower Lake flood, which is the chief cause of the long and injurious Upper Lake floods, would quite cease, and thus their channels would be improved. Therefore, I think that the preservation of the navigation entails a far larger share of the cost than has been hitherto estimated, consisting not only of the sluices at Belleek but of almost all the work from Portora upwards.

FOR MANY REASONS THE SUMMER NAVIGATION MUST BE PRESERVED.

12. In the plan now set forth I propose not only to preserve but to improve the navigation, by affording an unbroken surface from Belleek to Belturbet, at a level slightly higher than the present assumed Summer level, with a minimum depth of 6 feet over shoals. This navigation is necessary not only for commercial intercourse with the canal system of Ireland and to comply with Acts of Parliament, but for the yachts of the numerous nobility and gentry who live along the lakes, and their inlets, and to open up so fine a route for tourists; the general appearance of the lakes maintained at a full level adding to the natural beauty of the scenery, whereas a dry barren margin left round the lower lake in summer, as by some plans proposed, would much injure its charms.

VOLUME OF WATER IN LOUGH ERNE'S HIGHEST FLOOD.

13. The groundwork of every drainage plan must be a knowledge of the maximum flood. In the case of Lough Erne, after due consideration, it is assumed to be 600,000 cubic feet per minute passing at Portora, and 830,000 cubic feet passing at Belleek. I accept these figures, but at same time bear in mind Mr. Roberts' opinion (see his fourth Report on Mr. Barton's plan), where he states that during a period of seven years (67–74) the influx of "water into the lake and river above Enniskillen has amounted to more than 550,000 cubic feet per minute for four consecutive days, only on two occasions—one in October, 1870, and one in January, 1873; and that the influxes above 550,000 cubic feet per minute have not been frequent, and are of much shorter duration." This opinion is farther confirmed by the average of flood-water passed off from many of the catchment basins in Ireland—namely, the Shannon, Lough Neagh, the Boyne, the Corrib, and Lough Oughter, which comes to ·63 cubic feet per minute per acre. If we apply this scale to the catchment basin of Upper Lough Erne, which does not differ from the average natural circumstances of the above basins, we get 533,000 cubic feet per minute as the maximum influx at Portora, and if we raise the scale to ·75 or three-fourths of a cubic foot per minute per acre to the catchment area of the Lower Lake, we get 658,000 cubic feet as the maximum discharge at Belleek.

14. With all these opinions and calculations before me, I have provided channels from Upper to Lower Lake, and from Lower Lake to Belleek respectively, which will provide either for—(*a*) four days' continuous flood at Portora, of 550,000 cubic feet per minute, (*b*) or for waters gradually rising to this amount for six days, and then subsiding, (*c*) or for two days' excessive flood coming on suddenly, of 600,000 cubic feet, (*d*) or for a gradual rise to this maximum, say in four days, and then subsiding. These cases probably would include all the highest floods, except some abnormal flood after a cycle of many years, and which would only cover a small area of lands, perhaps, for a day.

INTERMEDIATE LOCK IN RIVER BETWEEN LAKES NOT DESIRABLE, AND ALSO CAN BE AVOIDED BY USE OF TELEGRAPH.

15. Mr. Lynam's third plan and Mr. Barton's plan have followed the same lines as Mr. Forsyth's for accomplishing the double object of drainage and navigation—namely, a full cut from Belleek to the Lower Lake, a clearance of the passages between the two lakes, and an intermediate range of sluices and lock for navigation at Knock Island, between the Upper and Lower Lakes. The essential difference of the plan now proposed is the omission of this lock and sluices, and the use, in order to attain the same purpose, of a self-registering telegraph apparatus from a station on the Upper Lake to Belleek, whereby every rise of its surface would be marked in the superintendent's house at Belleek, which would enable him to have complete knowledge and control of the drainage and navigation.

16. I am prepared to show hereafter, by working out any case of flood which might arise, that this lock is unnecessary; which was also the opinion of the late Mr. Barry Gibbons, the late Sir R. Griffith, Mr. Richard Hassard, and other eminent engineers; to which I would add that my proposal to apply a telegraph is the fruit of ten years of my own experience, during which I have largely availed myself of its use to regulate floods.

MODE OF MAINTAINING HEIGHT OF SUMMER WATERS WITHOUT AN INTERMEDIATE LOCK.

17. The principle to be adopted is—either to keep the two lakes nearly at the same level as would be the case in dry weather, or in winter to reduce the Lower Lake only so much down that it could be raised and refilled by the surplus water from the Upper Lake, and flowing into Lower Lake within a certain time. For instance, if, by a sudden flood in summer, the Upper Lake rose 12 inches, it would be proper to allow the Lower Lake to fall 4 inches, as this excess, 12 inches in the Upper Lake, is just enough to refill the Lower, because the latter is three times the area of the former. In a wet season it would be prudent in such case to reduce the Lower Lake 6 inches, to allow for water flowing into both lakes; and to keep it at this level, while the Upper Lake would be about eight inches up, making a difference of level of about 1 foot 6 inches, and passing half-flood waters, say 300,000 cubic feet per minute.

ITS DISADVANTAGES.

18. May be enumerated:—

a. Cost of construction of lock and sluices, and of increased depth of channel through the shoals from the sluice to the Lower Lake, and outlay from time to time in repairs.

b. Wages of second lock-keeper and his assistant.

c. Neglect, delay, or haste in opening the sluices at Knock Island (as the ponding area above is small) might produce very injurious consequences to navigation or drainage.

d. The delay to steam boats and barges in passing even one lock, through one narrow channel, is so great as to mar the advantages and pleasure of travelling over otherwise an unbroken sheet of water, and would largely increase their commercial costs.

ARTERIAL DRAINAGE OF RIVERS OMITTED.

19. Another difference exists in the plan now proposed—namely, the omission of extensive clearances up the tributary rivers. As each river can be best cleared by the landlords of its own basin, and as the costs, per flooded acre relieved, vary much for different rivers, and are almost always much less than for the great works combined also with navigation necessary for the main channel of Lough Erne, we have therefore applied ourselves wholly and solely to this latter main work, and only purpose to remove the shoals near the river mouths, so that their lowest lands may get the full benefit of safety from the present lake floods.

PROPOSED WORKS, FROM BELLEEK UPWARDS.

20. We thus propose to discharge and prevent the present lake floods, as far as they reach up the numerous rivers, in many cases several miles from Lough Erne; but above and beyond the limits of these floods we do not propose to undertake any works.

All the works now proposed are clearly set forth on the Ordnance sheets, enlarged plans, sections, and cross-sections of the channels, as follows:—

AT BELLEEK.

21. A deep channel, with gradually increasing width and diminishing fall, to be excavated from Belleek bridge upwards, capable of discharging 600,000 cubic feet per minute with the Lower Lake 6 inches below its summer level, which is Ordnance height 152·66. Upon this cut immediately below the present Belleek Eel Weir, one rising sluice and two opening flood-gates, each of the three with a clear waterway of 30 feet in width, or 90 feet altogether, are to be constructed.

THE SLUICE.

22. The sluice is to be capable of being lifted easily by being made to bear against free friction rollers, according to the patent of Mr. F. Stoney of Westminster.

FLOOD-GATES.

23. The flood-gates are to be of a kind used at Vreeswyk, near Utrecht, in Holland, which are found to act well under the most trying circumstances. They are made in the form of two lock-gates fixed together to a common heel-post forming a right angle, one angle closing the direct passage, and the other a side passage. The pressure on either leaf can be lessened by opening small sluices in themselves, whereby a force is generated which opens or closes the gate.*

24. The site chosen for the sluice and flood-gates is much nearer Belleek-bridge than was contemplated in former plans, at which place, from the greater depth of opening, less width will suffice to discharge the required volume of water. Besides, in this site there are special facilities of construction—namely, the whole masonry can be constructed perfectly dry, without pumping or expense in dams; and the foundation will be hewn out of the solid rock, the material being used for the walls and piers; the floor of the channel will be also solid rock, requiring no inverts.

WATER-WHEEL OF CHINA MILL.

25. As it is intended to maintain the Lake to its full level throughout the greater part of the year the injury to the water-power of Belleek Potteries will be of short duration, and only while floods last; still, to meet such cases, the head-race will be deepened, so as to convey a greater quantity of water than at present—the wheel, being a breast wheel, with the water entering above the centre, and working in a close-fitting stone channel, will work effectively with a less fall; and provision is to be made for any loss of power by the erection of an additional wheel, which can be most conveniently fitted to work extra machines already intended to be added by the proprietors of the Potteries.

CHANNEL FROM BELLEEK TO ROSSCOR.

26. A channel 250 feet wide, with a bottom 10 to 11 feet deep, below the inclined surface of the water when floods are being discharged, to be excavated from Belleek Island to Rosscor, being the entrance of the Lower Lake. The eel weir at Carrowkeel must be quite removed; but I have not considered in my estimate the necessity, if it exists, of its purchase.

27. The work from Belleek to this point forms the key of the whole plan, and, were it alone done, immense benefits would arise, as it is manifest that the obstructions here cause the great delay in the passing away of the floods.

28. The heavy rains of this June came on before the lakes had fallen to their usual summer level. The gauge at Belleisle fell slowly from 32 inches, on the 28th of May, to 26½ inches above zero (summer level) on the 8th of June: from that date it rose steadily to 75 inches on July 11, and then, after slowly falling to 37½ inches August 22 to 25, it again rose to the most unusual height, at this season of the year, to 84¾ inches on Sept. 14, its maximum height this summer. It is needless to add that this long flood at this season, over 12,000 acres of meadow and pasturage, has been the cause of immense loss.

PORTORA.

29. The next obstruction occurs at Portora, where it is proposed to enlarge the channel so as to discharge, with a fall at this place at rate of 2 feet 9 inches per mile, 550,000 cubic feet per minute, with the Lower Lake 6 inches below summer level.

30. A portion of the excavation will be made through rock—it is, however, flat bedded limestone, and its removal, though partly under water, will not be attended with any other special difficulty.

WEST BRIDGE, ENNISKILLEN.

31. It is proposed to carry nearly the whole flood discharge through the west channel at Enniskillen, and to leave the east channel as now, and by a new bridge of two spans of 70 feet each with a depth of 12 feet, in place of the present bridge of three arches, to provide both ample watercourse and navigation room.

FILL UP EAST CHANNEL.

32. It is here a matter for consideration how far it would be desirable to fill up the east channel, for a certain distance, with the stuff excavated at Portora and Enniskillen. The area of the town of Enniskillen, now cramped on an island, might be thus enlarged, and also joined to the mainland, where its present severance has many disadvantages. This question is, however, for the local authorities, if they should think fit to take advantage of this occasion. We can only add that the West-bridge will quite suffice for our purposes.

KILLYHEVLIN.

33. The shoal at Killyhevlin to be cut, so as to pass, with a fall of 1 foot 6 inches per mile, 510,000 cubic feet per minute; the diminution of section is because we are now above the mouth of the Sillies River.

INISKEEN AND KNOCK ISLAND.

34. Boulders of large size to be removed in mid-channel between Culky and Iniskeen; also channels west and east of Knock Island to be enlarged.

INISMORE, WEST CHANNEL.

35. Along the west Inismore channel to the Upper Lake, shallows at Drumcroole and Drumcramph to be cut through, and the shoal just below the mouth of the River Arney to be removed.

INISMORE, EAST CHANNEL.

36. The east channel to be cleared at Carragheens, Carry Bridge, and Belleisle Oak wood.

CHANNELS SUFFICIENT TO DISCHARGE GREATEST FLOODS

37. It is calculated that these channels will discharge a flood of 550,000 cubic feet per minute at

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* A Model will be exhibited at Inquiry.

Portora, and 500,000 cubic feet per minute at the Upper Lake, with a fall between the two lakes of 3 feet 2 inches—that is to say, the Upper Lake will be 2 feet 4 inches above its summer level, and the Lower Lake 6 inches below its summer level, and, as there is 4 inches difference between the summer levels, the whole fall will be 3 feet 2 inches.

SEVERAL CASES OF FLOODS CONSIDERED.

38. Taking the case of the maximum floods to which Mr. Roberts refers in his Fourth Report, which occurred twice only during seven years—namely, 550,000 cubic feet per minute, for four consecutive days, the result would be as follows:—Assuming it to take place in the rainy season (which is the worst case), the river say passing half maximum flood, the Upper Lake would be about 8 inches above its summer level (as it was in October, 1870, before the great flood), and the Lower Lake 4 inches below its summer level. Upon the first day of flood the channels would be discharging about 330,000 cubic feet per minute, the Upper Lake would rise 11 inches Upon the second day of flood the channels from Upper Lake would be discharging about 420,000 cubic feet, and it would rise about 5 inches. On the third day the lake would rise $2\frac{1}{2}$ inches, the channels discharging 480,000 cubic feet. On the fourth day the lake would rise $1\frac{1}{2}$ inches more, the channels discharging 500,000 cubic feet, after which the discharge would equal the influx, which latter would moreover begin to abate. It may be shown that during these four days the Lower Lake, having an outlet at Belleek carrying above 600,000 cubic feet, would not only have carried away all the flood from above Portora, but also the flood from its own catchment basin, and would have fallen about $1\frac{1}{2}$ inches.

39. Thus the greatest flood of seven years would have been passed with a rise of the Upper Lake of 2 feet 4 inches above its summer level.

40. With an extra great flood of 600,000 cubic feet, lasting only two days, the result would be practically the same, or there would be rather a less rise of the Upper Lake

41. Another case might be taken of a flood rising gradually for six days to a maximum, and falling gradually for six days, which would produce about the same rise of the Upper Lake.

WORKS IN UPPER LAKE.

42. The works in the Upper Lake and rivers may be described as follows:—

43. Shoals at the mouths of the Swanlinbar River to be removed.

44. The shoal at the mouth of the Colebrook River to be excavated.

45 Along the course leading to the Ulster Canal navigable channels to be cut at Gubbe, Quivvy, and Derrykerrib, and through Edergoole to Finn River.

FOALIES CUT; ITS BENEFITS TO NAVIGATION.

46. On the Belturbet Channel it is proposed to cut the isthmus at Foalies, which would shorten the route between Enniskillen and the Ulster Canal and Belfast by $1\frac{5}{8}$ of a mile, and between Enniskillen and Belturbet by 5 miles in summer, and 2 miles in winter; and would unite directly the Ulster and Ballinamore Canals, saving over $3\frac{3}{8}$ miles of intricate channels. It would also afford an additional passage for the flood waters of the Upper Erne. This work is, therefore, of the utmost importance, and well worth its outlay. The principle part can be excavated dry, and the limestone excavated may be of considerable value. This channel is to be 25 feet in bottom width. A small bridge will be required to carry the county road into Derryiny.

NAVIGABLE RIVER CHANNELS.

47 Navigable channels to be cut at Bloxham's Ford, Pink Grove, and Belturbet.

48. Three shoals to be removed in the Woodford River, and the Finn to be cut according to the section, and some bridges to be underpinned or inverted.

WORK SHOWN ON PLANS.

49. All cuttings are shown on enlarged sections, plans, and cross-sections.

CONTRACTS.

50. The proposed works may be let all together or in three contracts, numbered respectively 1, 2, and 3, viz:—

No. 1.—From Belleek to Rosscor.
No. 2.—From Portora to Upper Lake.
No. 3.—Works in Upper Lake and Rivers.

51. The two first contracts might be let simultaneously, and the last after these had progressed considerably. Assuming the cuts to have been made at Belleek, Portora, and Killyhevlin, &c., and the Upper Lake allowed to fall during one summer below its natural level, the excavations of the 3rd contract could be easily made. The whole work might be completed in three years.

ESTIMATE.

52. The estimate of the cost is set forth in detail, calculated at the same prices as were approved of in the estimates of previous plans, even though since the period at which they were brought forward both wages and cost of material have fallen.

CONTRACTORS.

53. It is expected that a work of such magnitude would fall into the hands of contractors possessing skill, plant, and means for its successful accomplishment, who, at the same time, would work at fair remunerative prices.

FINANCIAL.

54. The total cost is estimated at £93,800, of which £30,000 is chargeable to navigation.

55. As to the increased value of the land to be improved, it amounts to £5,308 upon 17,405 acres, or an average annual benefit of 6*s.* per acre—while the average annual charge on these lands, *i.e.*, 5 per cent. for thirty-five years, to pay off the outlay for drainage (£63,405), will be only an average of 3*s.* 6*d.* the statute acre.

56. This moderate plan now proposed is such as will really meet all the requirements of drainage and navigation, and give the greatest benefits for the least outlay.

FLOOD DRAINAGE—LOUGH ERNE.

Estimated Cost of Works, as proposed and described on Plans and in Report prepared by James Price, C.E., 1879.

Section No. 1.

Belleek to Lower Lake.

	£	£
New Wheel at Potteries, &c., . .	1,000	
Sluices and flood-gates, &c, . .	4,912	
Telegraph and Superintendent's House, .	880	
Rock-cutting, Belleek, 30,581 c. y., at 2*s.* 6*d*,	3,822	
Earth cutting, Belleek, 79,089, c. y., at 10*d*,	3,295	
Belleek to Rosscor and Mill-race:—		
Rock-cutting, 60,000 c. y, at 2*s.* 6*d*, .	7,500	
Earth cutting, 626,921 c. y, at 10*d*, .	26,121	
		47,480

Section No. 2.

Portora to Upper Lake

	£	£
Portora—		
Rock, 12,000 c. y., at 4s., . . .	2,400	
Earth, 24,731 c. y., at 10*d*., . . .	1,030	
Enniskillen—		
20,146 c. y., at 10*d*., . . .	839	
West bridge and retaining walls, . .	4,212	
Killyhevlin—		
70,203 c. y., at 10*d*., ...	2,925	
Culky—		
600 c. y., at 10*d*., ...	25	
Carragheens—		
3,333 c. y., at 10*d*., ...	130	
Drumcroole—		
2,963 c. y., at 10*d*., ...	123	
Drumcramph—		
11,852 c. y., at 10*d*., ...	493	
Black Rocks—		
Rock, 2,400 c. y., at 2s. 6*d*., . . .	300	
Earth, 7,960 c. y., at 10*d*., . . .	332	
Carry bridge—		
2,780 c. y., at 10*d*., ...	115	
Under-pinning, ...	250	
Belleisle—		
5,925 c. y. at 10*d*., ...	246	
River Arney—		
21,000 c. y., at 10*d*., ...	875	
		14,295

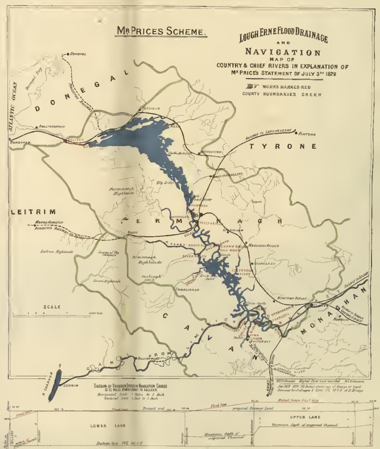
Section No. 3.

Upper Lake and Rivers.

Gubbe, 6,800 c. y., at 10*d*., . . .	283	
Quivvy, 3,333 c. y., at 10*d*., . . .	130	
Derrykerrib, 13,333 c. y., at 10*d*., . .	555	
Edergoole, 3,704 c. y., at 10*d*., . . .	154	
Colebrook R., 39,000 c. y., at 8*d*., . .	1,300	
Swanlinbar R., 5,333 c. y., at 8*d*., .	177	
River Finn, 6,090 c. y., at 10*d*., . .	253	
„ bridges, underpin., . .	100	
Woodford R., 12,000 c. y., at 10d., . .	500	
Foalies—		
Rock, 11,800 c. y., at 2s., . . .	1,180	
Earth, 5,513 c. y., at 8*d*. . . .	184	
County-road bridge, ...	300	
Land, 3A., at 13s. 4*d*., 25 years, . .	50	
Bloxham's rock, 13,700 c. y., at 2s. 6*d*., .	1,713	
Pink Grove and Belturbet, 10,444 c. y., at 10*d*.,	435	
		7,314
Providing power or compensation for short time cutting mill-race, Belleek, . . .	—	500
Re-arranging and stoppage eel weir, do. .	—	200
Corn and saw mill, do., ...	—	200
Small lots of land for spoil, . . .	—	500
Net cost, ...	—	70,489
15 per cent., Contingencies, . . .	—	10,573
		81,062
Engineering, valuation, &c., ...	—	6,538
		87,600
Interest at 4 per cent. —		
£29,000 for 3 years, . . .	3,480	
£29,000 for 2 years, . . .	2,320	
		5,800
Total cost, .		£93,400

James Price.

October 4th, 1879.



MR PRICES SCHEME.

LOUGH ERNE FLOOD DRAINAGE AND NAVIGATION

MAP OF COUNTRY & CHIEF RIVERS IN EXPLANATION OF MR PRICE'S STATEMENT OF JULY 3RD 1879

WORKS MARKED RED
COUNTY BOUNDARIES GREEN

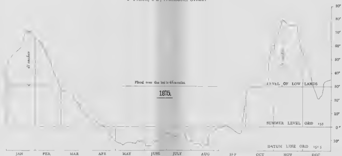
DIAGRAM OF UNDRAINED STRETCH OF NAVIGATION COURSE
52 ST MILES FROM BELTURBET TO BELLEEK
Horizontal Scale 7 Miles to 1 Inch
Vertical Scale 4 Feet to 1 Inch

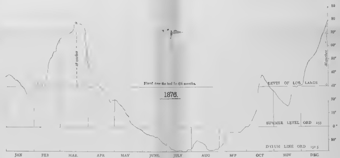
LOUGH ERNE DRAINAGE.

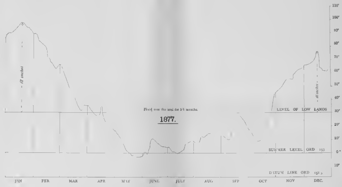
LEVELS OF UPPER LAKE.

Hor Scale 1½" = 1 Year
Vert Scale 1" = 20"

J PRICE, C E, 44 HARCOURT STREET







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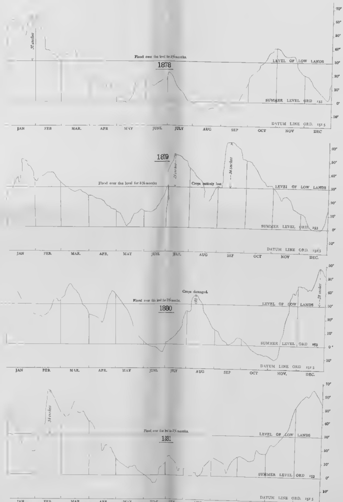
LOUGH ERNE DRAINAGE.

LEVELS OF UPPER LAKE.

Hor Scale 12" = 1 Year
Vert Scale 1" = 30"

J PRICE, C E, 44 HARCOURT STREET



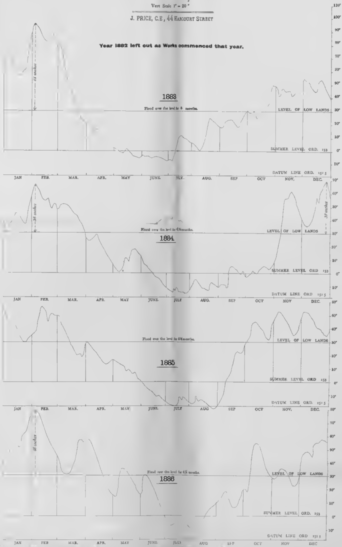
LOUGH ERNE DRAINAGE.

LEVELS OF UPPER LAKE.

Hor Scale 12" = 1 Year
Vert Scale 1" = 20 "

J. PRICE, C.E, 44 Harcourt Street

Year 1882 left out as Works commenced that year.

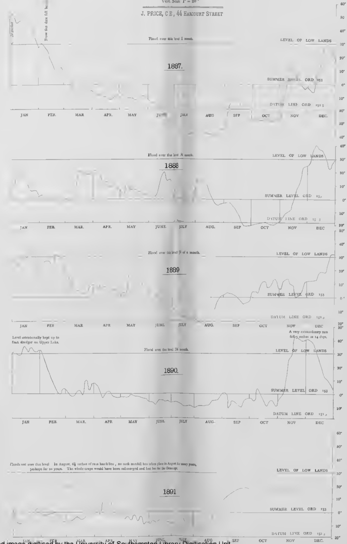


LOUGH ERNE DRAINAGE.

LEVELS OF UPPER LAKE.

Hor Scale 15" = 1 Year
Vert. Scale 1" = 20"

J. PRICE, C.E., 44 HARCOURT STREET



APPENDIX No. 8.

APPENDIX

LOUGH ERNE

SCHEDULE of the different SCHEMES submitted to the COMMISSIONERS of

AUTHOR OF SCHEME.	Date.	AMOUNT OF ESTIMATE.							
		NAVIGATION			DRAINAGE.			Works chargeable to Counties.	Gross Total.
		Navigation of Lough Erne.	Branch Navigations	Total for Navigations.	Main Channel	Tributaries	Total for Drainage		
		£	£	£	£	£	£	£	£
WILLIAM FORSYTH, C E, Board of Works.	December, 1847,	15,675	7,669	23 344	49,030	31,466	80,496	5,016	108,856
JAMES LYNAM, C.E.,	April, 1870,	—	—	—	—	—	—	—	69,239 This includes drainage and navigation; there is no means of separating them.
Do,	December, 1871,	—	—	21,328	91,188	12,400	103,588	1,720	126,636
Do,	November, 1873,	*—	*—	30,226	111,325	24,601	135,926	1,720	167,872
JAMES BARTON, M Inst C E,	February, 1873,	24,826	7,121	31,947	94,759	36 383	131,142	4,667	167,756
JAMES PRICE, M. Inst C.E,	October, 1879,	26,955	3,045	30,000	63,047	353	63,400	—	93,400

** These items cannot now be

No. 8.

DRAINAGE DISTRICT.

Public Works for the Drainage of the Flooded Lands in the above District.

PARTICULARS OF SCHEME.					Name of Inspector.	Observations.
Area of Land to be drained and improved, Statute measure	Estimated increase in value per annum.	Return per cent.	Cost per acre.	General Description		
Acres.	£	£ s. d.	£ s. d.			
17,555	6,729	8 6 8	4 11 9	It was proposed by this scheme to permanently lower the level of the water in the Upper and Lower Lakes and the channels connected therewith, so as to relieve the adjacent low-lying lands from floods, giving a 7 feet navigation throughout; the Upper Lough being ordinarily maintained 33 inches above the Lower by a sluiced weir and lock at Knockisland, and to straighten, deepen, and improve the tributary rivers, streams, and drains in order to effect the drainage of the flooded lands remote from the Lakes and main channel to a certain extent.	None,	Acts 5 & 6 Vic, c 89, 8 & 9 Vic, c 69; 9 Vic, c 4, &c Sec 11 of the latter Act provides that the assents of proprietors for more than one half in extent of the lands to be drained and improved be deemed sufficient to bring this Act into operation. The assents were in a minority in this case, and the Board of Works were unable to proceed further with the matter. The Valuators were Messrs Brassington and Gale
15,650	—	—	—	This project contemplated relieving the low lying lands from *Summer and Autumn floods only* in the vicinity of the lakes, main channels, and the lower parts of the tributary streams, leaving a 6 feet navigation without a lock.	Samuel U. Roberts, M. Inst., C.E.	26 & 27 Vic, c 88, &c Estimate increased by Inspector to £89,596 Scheme not approved, and documents returned for revision by the promoters. The Valuator was James Brady, C E.
17,438	7,155	6 18 0	5 18 10	Do., do, leaving a 5½ feet navigation without a lock.	Do., . .	Estimate increased by Inspector to £165,282 Scheme not approved, and documents returned for revision by the promoters The Valuator as before
17,438	7,155	5 5 3	7 15 11	This scheme was revised partly in accordance with the Inspector's suggestions in his reports on the two former projects, leaving a 6 feet navigation with lock.	Do., . .	This scheme fell through, and the promoters would not proceed with it further The Inspector reduced the estimate to £165,289 The Valuator as before.
20,633	7,833	5 19 5	6 7 1	This scheme coincides with the main features of Mr Forsyth's as above, submitted in 1847, providing for a 7 feet navigation with lock, and includes the improvement of the tributary rivers, streams, and drains in a similar manner	Do . . .	The Inspector reduced the area to be drained to 19,417 acres, and the increase in value to £7,327 The estimate was increased to £169,578 The Valuators were Messrs Brassington and Gale
17,405	5,308	8 7 5	3 12 10	This project was to maintain an uniform level for navigation (depth not stated) from Belleek to Belturbet, a distance of 50 miles, thereby permanently lowering the surface in the Upper and Lower Lakes and the connecting channel The tributary rivers, streams, and drains were not proposed to be deepened and improved The scheme, therefore, will not effect the drainage of the lands remote from the lakes and main channel	F. Hawksley, M. Inst., C.E.	The Inspector increased the estimate to £104,000 The Valuator was James Brady, C E The proprietors gave their assents, and the scheme was subsequently carried out

separated as regards this Scheme

DUBLIN: Printed for Her Majesty's Stationery Office,
By ALEX THOM & Co. (Limited), 87, 88, & 89, Abbey-street,
The Queen's Printing Office